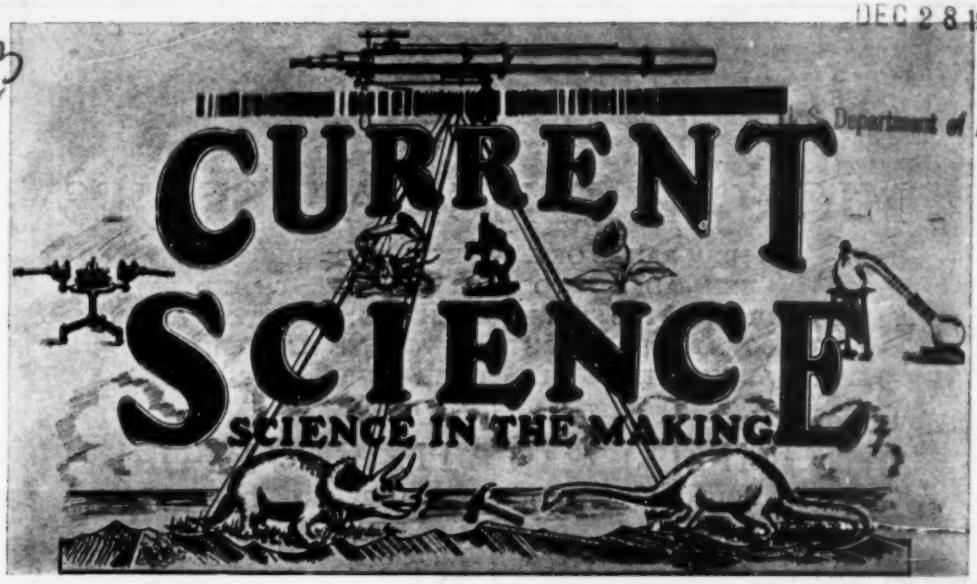
REGD. NO. M. 2799.



Vol. II] AUGUST 1933 [No. 2

A MONTHLY JOURNAL DEVOTED TO SCIENCE.

Published with the editorial co-operation of

Vol. II] AUGUST 1933 [No. 2

CONTENTS.

University Reform—I.

WE hoped to be able to offer our observations on the Report of the Punjab University Committee in this month's issue of *Current Science* but though we applied to more than one agency for a copy of that undoubtedly interesting document, we were unable to procure one in time. Anticipating its arrival we propose to record here a few general reflections on the lines of reform along which the universities might develop their resources and extend their sphere of usefulness.

Broadly speaking, the character of a modern university is moulded by three well-defined influences. The first of these is the type of knowledge which it seeks to promote. This obviously has an important bearing on the organization of research and the curricula of studies. The second influence is that of the quality and type of citizen which it intends to produce. The power of a university to raise a body of leaders in thought and action depends on its cultural traditions, its reputation and atmosphere built up by its ideals. The third kind of influence which affects the complexion of a university is the nature of the political, social and economic environment in which it is situated. Theoretically it is true that the higher interests of the universities should not be subordinated to the obligations of financial assistance which they receive from the governing authorities. There is bound to be difference of opinion as regards the extent to which the vital forces of the country can be permitted to impinge on the legitimate functions of the universities, but there can, however, be little doubt about their attitude towards national problems.

Recently Indian universities have unfortunately been subjected to public criticism from more than one standpoint. They are regarded as the direct cause of unemployment and therefore, among the proposed remedial measures to overcome the evil, suggestions are made to convert them into technological institutes. Despite all criticisms, no university in India can relinquish its position as 'a corporation of teachers and students devoted to the quest of truth' nor can it give up its function of educating the latter to responsible membership and collaboration in the practical endeavours of society so that 'the national and cultural welfare of the people as a whole may be served'.

It seems to us that we should be taking a narrow view of the functions and responsibilities of the university if they are confined to the preparation of students to be scientific researchers, good doctors, lawyers, administrators, engineers, financiers, industrialists and politicians. The empire of the university is the whole range of the human mind and by virtue of the academic prestige it enjoys and the mass of knowledge it possesses, it has acquired virtually the competence to offer solutions to world problems. The policy of non-intervention in affairs lying outside the academic sphere has tended to preserve the freedom of learning and thought and its abandonment may be desired only if it does not involve the sacrifice of liberty. Frequently the universities become involuntarily incorporated into the political, social and economic structure of the State. In countries like Italy and Russia the universities have become subordinate branches of the State which prescribes their policy, directs and controls their academic functions. Though the German universities are practically all of them State institutions they enjoy greater freedom, but it is not unlikely that the Nazi idea of the Nordic Superman may soon supplant their old ideal of humanism. It is only natural that the tendency to concentrate on matters and activities outside the university should be strongest in countries which have broken loose from the pre-war academic traditions. In France and England the continuity of educational ideas is still maintained because the social and political facts of these countries have not undergone such a radical transformation as has overtaken the Central European States. 'Plans of reform in France and England have been confined to adjustment of the universities to the increasing demands of an enlightened democracy' and questions such as access to the university and the selection of students for higher training have claimed greater attention. In the United States learning is made subservient to the immediate practical ends of the people and the tendency to give university education to the maximum body of students has admirably built up American democracy.

Proposals of reform generally deal with the technical aspect of university education and the powers and constitution of university bodies. We sometimes shorten certain courses, add new faculties, prescribe more books, stiffen and prolong examinations, enhance fees and demand longer attendance, discuss rules and regulations, become jealous of powers and privileges of authorities and also take into account matters outside the university such as hostels, sports and unions. None of these things can have real significance unless we have a clear conception of the university itself. The new universities cannot afford to remain in cloistered seclusion impervious to the impressions of a rapidly changing world. They must be nurseries of big ideas and big men. If the universities have a limited programme it is no doubt true that they are likely to achieve definite results and one of them must be to train the intelligence of young men so as to enable them to turn their talents on any human enterprise with success.

One of the causes which militate against the attainment of this modest ambition is the large number of students the universities are required to handle every year. The result is a tendency to mechanize the mind by reducing human contacts to the minimum. The situation becomes almost tragic when we turn to the students. The pressure of numbers precludes them from imbibing the traditions of university life and from completely understanding the teachers whom they meet. So the world of students touches that of teachers only at official points and few other bridges are possible to be established. The young men desire leadership and we can offer them none to guide and instruct them in the affairs of the world. They wish for certainty and clear definition of the aims of popular movements and we give them no fresh ideas that fire their imagination. When confronted with situations which do not satisfy their higher intellectual ideals, the students look upon the university instruction as little better than a preparation for obtaining a livelihood. True, they acquire an enormous knowledge of disconnected facts and pass examinations. These lead them nowhere. Their inner intellectual restlessness and teasing doubts do not find a satisfactory answer and their labours in the class room do not provide them with employment. It should be no wonder that in such circumstances they should listen to the voice of the false prophets and follow them in the forlorn hope that 'their teachings will lift them ultimately out of their physical and mental misery'. They have faith in them because they are convinced that these leaders are nearer to the realities

of life than their teachers and also because they imagine that, out in the heat and tumult of popular agitation, there is baking for them the bread for the satisfaction of their intellectual and physical hunger.

The interests of our generation are fundamentally economic and it will not be possible to prevent young men from entering the universities in increasingly large numbers to avail themselves of university education as an equipment for careers in life. Few of them can afford to take the academic type as their ideal of university training. The reaction of the university to this influx is to impose hypertrophied qualifications by a continuous stiffening of the course of study and standards of examinations. A few years ago the rise in the number of students used to be enthusiastically welcomed as a sign of increasing national progress but to-day we are unconsciously striving to limit the admissions. The growing number of students is more an index of their distress from which they hope to seek temporary relief in the university. The idea of mass education in a university is opposed to its character as a home of culture. An overflowing class offers no opportunities for personal contacts, effective collaboration in studies and practical participation in research. When lectures are to be addressed to a vast body of students it becomes an anxious question whether every member is kept diligently employed and whether they are not otherwise industriously occupied. We can hardly blame them. The pressure of economic necessity weighs too heavily upon them to realize that university life is a time of carefree enjoyment of a series of intellectual banquets. When we realize how many students are obliged to earn while studying and how incessantly they have to toil, we should be less hasty in pronouncing judgment on the great transformation of character which distinguishes the present from the past generation of students. We should not at the same time forget that the bulk of them belong to social orders from which they inherit no pronounced predisposition to learning. The present period is really a crisis in learning and as a period of transition its problems must necessarily be complex.

We hardly succeed in getting an insight into the mind of the younger generation to whom university reform is only a part of universal reform of human society. The university secluded from town life has no significance to them who wish to keep in lively touch with its bustling activities. They want really a university which can equip them far more efficiently than before for the service of the people and the state. They wish to become prosperous citizens, capable leaders, efficient businessmen and wise administrators. They see disintegration of the old social order and hope to assist in building up a more stable one on a rational basis,—essentially human. They wish to see the inauguration of the new state with a new type of "full man" bringing with him a purer code of morality and social justice. The "economic man" has not satisfied their higher impulses nor have his doctrines enabled them to see visions of universal harmony and peace. Do the universities provide such a type of student with a satisfactory answer, offering him opportunities to realize where dreams end and where hard matter-of-fact life begins? The idealism of youth is an excellent asset for the university whose existing machinery, however, is ill-adapted for transforming it into an efficient instrument of service.

Besides dreams of service, the heart of the student is filled with ideas of liberty which for lack of clear interpretation are likely to be misapplied. It is true that 'life without liberty has little significance,' but the liberty which gives ethical reality to man disciplines his mind, promotes respect for ordered society and delights in the supreme joy of labour. Has the student opportunities of conversing or consulting with maturer minds in order to realize that 'liberty which is not love is nothingness' and that it is 'a negation of society'? Liberty in the higher sense of the term is the will to strive, to serve and to act faithfully and dutifully. In the hurry and distraction of modern life the word liberty is misunderstood in its real scope and in its implications.

The student is the hub of the university. The teachers and all the paraphernalia of education gravitate towards this human pivot. In reforming the university the student problem is undoubtedly the most difficult and puzzling. Recasting of studies, examinations and everything else is easy, for they are all immaterial and any number of alterations of these will not enable the university to fulfil their higher functions unless and until the growing human mind in all its myriad complexities is brought to respond to the reforms sympathetically, nobly and fully. No university reform can be satisfactory if it is not intended to foster

in the mind of the student and that of the teacher 'the idea of the oneness of knowledge' and to emphasize that 'scholarly work is service to civilization'.

Sir Richard Gregory, Bt., F.R.S.

THE tidings that Sir Richard Gregory, editor of *Nature*, has been elected a fellow of the Royal Society will have given wide spread satisfaction among those who enjoyed the privilege of meeting him and Lady Gregory during their visit to this country in January and February of the current year.

Among the statutes of the Royal Society is one, seldom brought into operation, enabling election of a personage who, in the opinion of the Council, has rendered conspicuous service to the cause of science, or whose election is deemed to bring signal benefit to the Society. It has been customary to elect successive Prime Ministers under this statute, but we do not recall its application to other persons of eminence. Thus a special interest attaches to the election of Sir Richard Gregory, whose service to the cause of science is indeed conspicuous. During an association with *Nature* extending over forty years, and particularly under his long continued editorship, the publication has become unique. Its wealth of information in all branches of science, the courageous and broad-minded survey of such current affairs as relate to the progress of science, the cultivated and informative reviews of books, and the diverse correspondence columns, are features now so familiar to the scientific world that we can appreciate them at their true value only by considering for a moment the blank in our lives that would ensue were *Nature* to vanish.

On behalf of our readers we offer Sir Richard Gregory the warmest congratulations of *Current Science*. Since his return to England Sir Richard has been gravely ill, but the mail announcing his new distinction announces also his convalescence, and the hope that his health may be soon restored to its original vigour will be universal.

Joseph Priestley, 1733-1804.

THE bicentenary of Priestley's birth on 13th March, 1733, received special recognition by the Chemical Society at its meeting on 6th April, 1933, when addresses on his life and work were delivered by Professor A. N. Meldrum, Sir Philip Hartog and Sir Harold Hartley. These emphasized his remarkable personality, his nobility of character and the novel contribution to chemical practice arising from his facility in handling gases.

The life of Priestley merits attentive study by all students of science, old and young. He was a genuine philosopher inasmuch as he loved wisdom in all the branches then accessible, and his command of languages was extraordinary. His piety and rectitude were so pronounced and so commingled with curiosity regarding natural phenomena that they invited the persecution of an intolerant age; and it is one of life's ironies that he narrowly escaped destruction on account of his revolutionary sympathies when Lavoisier was beheaded for his counter-revolutionary proclivities. Probably the only years of peace he knew were the concluding decade of his life, spent with his family in Pennsylvania.

Scientific experiments were for him a hobby early adopted and faithfully pursued. His admission that he was "not a practical chemist" in part explains his outstanding success, because, as we are reminded by Dr. Meldrum, he declared that "if I had been accustomed to the usual chemical processes, I should not so easily have thought of any other; and without new modes of operation I should hardly have discovered anything new". His work on gases began in 1767, but he was nearly forty before the experiments with air, and the exact date of his discovering oxygen remains obscure: in fact, the careful survey of correspondence submitted by Sir Philip Hartog to *Nature* (1st July, 1933, p. 25) indicates "before the month of November, 1771" as being probable, the experiments of 1st August, 1774, in Wiltshire and of 1st March 1775, in London, being confirmatory and extensory.

In referring to his outstanding discovery Priestley has modestly recorded a reflection often recurring in the minds and writings of those interested in the relation of cause to effect when he says "it provides a striking illustration of a remark I have more than once made in my philosophical writings and which can hardly be too often repeated, namely, that more is owing to what we call chance than to any proper de ign or preconceived theory in this business". That reflection remains legitimate, but must be accepted only in conjunction with Pasteur's dictum that "in the field of observation chance favours only those who are prepared". M. O. F.

Locomotion of Fishes.

By Dr. Sunder Lal Hora, D.Sc., F.R.S.E., F.L.S., F.Z.S., F.A.S.B.,
Zoological Survey of India, Indian Museum, Calcutta.

THE muscular movements of fishes have been studied from a very early time, and the researches of Borelli,[1] Pettigrew,[2] Maurey[3] and Breder[4] deserve special mention in this connection. In spite of the wealth of literature available on the subject (see Breder for bibliography) the exact significance of these movements has only been realized during the current year as a result of the careful work of Dr. J. Gray[5] in the Laboratory of Experimental Zoology, Cambridge. It was believed that the fins of fishes are the main organs of locomotion, and that the fish impels itself forwards by the tail and the caudal fin. These conclusions seem to have been based on erroneous impressions, for the eye observes only the movements of the tail relative to the head instead of observing its motion in relation to the background of the fish. Dr. Gray has, however, recorded photographically the movements of a number of fish against a scaled background, and these records have enabled him to analyse the nature of the part played by different organs in the locomotion of fishes.

Superficially the motions of various types of fish appear to vary considerably from one kind to another. For example, the most conspicuous features of a moving eel are the waves of curvature which pass along the length of the body from head to tail. In the fast-moving mackerel the visible movements appear to be due to transverse strokes executed by the posterior end of the body across the axis of motion. Dr. Gray was able to demonstrate that the waves of muscular contraction occur in almost all fishes, but that these vary greatly in speed of propagation, amplitude and frequency. As in eel, the forward progression of fishes is mainly due to the waves of muscular contraction. It has been experimentally demonstrated by Breder in the case of *Scardineus erythrophthalmus* that it makes no appreciable difference in the "cruising" speed of the fish whether it moves with the caudal fin intact or with the caudal fin carefully amputated. These observations have been confirmed by Gray by the removal of the caudal fins of the rudd, the perch, and the whiting.

In a fish moving forwards the waves of muscular contraction start from the anteriormost region of the body, and it is found that the speed of propagation of the waves is too low to be controlled by the rate of conduction of a simple nervous impulse. The forward propulsion of the fish is due to the fact that its leading surface faces obliquely backwards relative to the head of the fish and that it moves at an angle to its own direction of motion. It is thus seen that so long as the leading surface is moving at an angle to its own path of motion, there will be a pressure exerted at right angles to the surface, and so long as the leading surface is directed obliquely backwards relative to the head of the fish, the pressure will be directed obliquely forwards. "The magnitude of the forward thrust depends, among other things, on (*a*) the angle which the surface of the fish makes with its own path of motion, and (*b*) on the angle between the surface of the fish and the axis of forward movement of the whole fish, (*c*) on the velocity of transverse movements of the body." Dr. Gray has shown that the underlying mechanism of propulsion of a typical fish is similar to that of a typical screw propeller. In this movement it is seen that each point on the body of the fish travels in a horizontal figure of 8 relative to a transverse axis which is moving forwards at the same average velocity as the whole fish.

The rôle of the caudal fin is to offer resistance to the transverse movement of the fish, and in this way it causes the posterior region of the body to lag behind all those parts which lie between itself and the point of contraction. As a result each group of muscles, as it comes into play, operates on a region of the body which is directed obliquely backwards relative to the head. The caudal fin is also responsible for a fairly large percentage of the propulsive thrust, which depends upon the nature of the fin and of the tail.

The directional control of fish movement is also considered by Gray and he finds that "in some cases such changes are effected by movements of the paired fins, but the rapid changes so characteristic of the pelagic types are effected by the muscles of the body itself. In all cases a change in the direction of motion has been found to be due to the propagation of a muscular wave along one side of the body, and the fish always turns towards the side along which the wave is travelling." The turning movement of a fish is divisible into two parts; during the first phase of the movement the head turns through the water by using the tail fin as a fulcrum, while during the second phase the tail moves through the water with the head as a fulcrum. From this it is evident that the amputation of the caudal fin exerts a very far-reaching effect on the turning power of the fish. The caudal fin is thus seen to exert two forces on a moving fish, "(1) it tends to inhibit the transverse movements of the hind end of the body; (2) it exerts a fraction of the forward propulsive thrust."

All the muscle fibres of the trunk as well as of the tail run in a longitudinal direction; their action is so regulated that when a fibre on one side of the body is fully contracted, its corresponding fibre on the other side of the body is fully relaxed. The muscle fibres nearest to the anterior end of the body contract first, and the energy thus generated is transmitted mechanically along the body length of the fish. The transmission of energy takes the form of tension of the stretched skin and muscles of the leading side. As the speed of transmission of the muscular waves is very variable, it seems likely that they are not due to any nervous impulse or disturbance.

Dr. Gray's papers are illustrated with beautiful and instructive plates and a large number of explanatory figures in the text. In a paper to be published shortly in the *Journal of Experimental Biology*, Dr. Gray promises to elucidate further the rôle exerted by the caudal fin during the normal locomotion of the fish. The publication of this paper will, it is hoped, help fully to understand the detailed mechanism of this important organ.

References.

[1] Borelli, G. A., *Philosophia de motu animalium ex principio mechanico-statico*, 2 Vols. (Romæ: 1680-82).

[2] Pettigrew, J. B., *Animal Locomotion* (London: 1873); "Animal Locomotion; or Walking, Swimming, and Flying, with a dissertation on Aeronautics." *Internat. Sci. Ser., New York*, No. 8, pp. 1-264 (1874).

[3] Maurey, E. J., *Le Movement* (Paris: 1894). "Movement", *Internat. Sci. Ser., New York*, No. 73, p. 323, Fig. 200 (1895).

[4] Breder, C. M., "The Locomotion of Fishes," *Zoologica*, **4**, 159 (1926).

[5] Gray, J., "Studies in Animal Locomotion: 1. The Movement of Fish with Special Reference to the Eel", *Jour. Exper. Biol.*, **10**, 88 (1933); 2. "Directional Control of Fish Movement", *Proc. Roy. Soc. London*, **113B**, 115, 1933; "Muscular Movements of Fishes," *Nature*, **131**, 825, 1933.

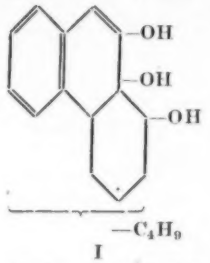
Chemistry of the Œstrogenic Hormones.

THE presence of an active substance in ovarian extracts which produces symptoms typical of normal œstrus in ovariectomised animals was first clearly demonstrated by Marshall and Joly in 1906. It was shown to be fat-like in its solubility and to be highly thermostable. Allen and Doisy in 1923 developed a rapid method for the quantitative assay of the hormone and in 1927 Ascheim and Zondek showed its presence in the urine of pregnant women. Shortly afterwards four different groups of workers, Doisy *et al*, Butenandt, Dingemanse, Laqueur *et al*, and Marrian, isolated independently the crystalline œstrogenic substance from the urine of pregnant women. In an article on the "Recent Progress in the chemistry of the œstrus producing hormone" in *Science Progress* (**28**, 69, 1933) Dr. Marrian discusses the several formulæ suggested for the substance. The work of the different authors mentioned clearly showed the presence of two chemically distinct œstrogenic substances in human pregnancy urine, a hydroxyketone of the formula $C_{18}H_{22}O_2$ and a triol, $C_{18}H_{24}O_3$. Butenandt and Hildebrandt in 1931 converted the triol into the hydroxyketone by dehydration *in vacuo* with potassium bisulphate. Since water was eliminated from the two non-acidic hydroxyl groups of the former, it was assumed that these two hydroxyl groups were attached to adjacent carbon atoms.

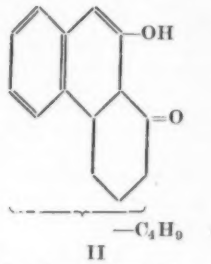
In 1932, Butenandt and Stormer separated two isomers of the hydroxyketone. A number of œstrogenic substances have been since isolated from the urine of mares. It seems likely that there are many closely allied œstrogenic substances yet to be discovered in human and mares' urine.

The work of Butenandt, Thayer, Levin and Doisy showed that besides three aromatic double bonds in the molecule of ketohydroxyœstrin there was another non-aromatic one. Marrian and co-workers showed later that the evidence on which the fourth double bond was postulated was untenable and that there were only three aromatic double bonds in the ketohydroxyœstrin molecule. This was confirmed by Butenandt by hydrogenation experiments.

On the former evidence of four double bonds the following formulæ were suggested for trihydroxyœstrin (I) and for ketohydroxyœstrin (II)

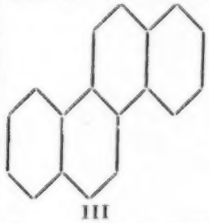


I

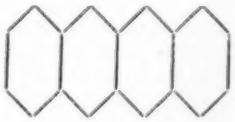


II

But when it was definitely shown that there were only three double bonds, the most probable carbon skeletons were the chrysene (III) or the naphthacene (IV) types.

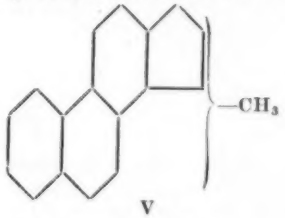


III

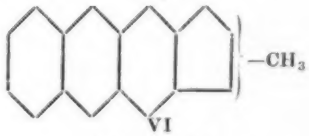


IV

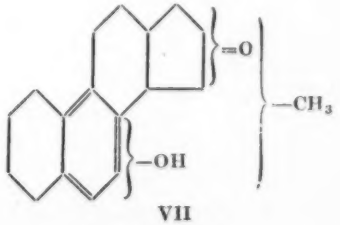
The results of Marrian and Haslewood in 1932, later confirmed by MaCorquodale, Thayer and Doisy in 1933, could be interpreted better on the basis of a five-membered ring than a six membered one. Therefore the most probable skeletons are V and VI



V

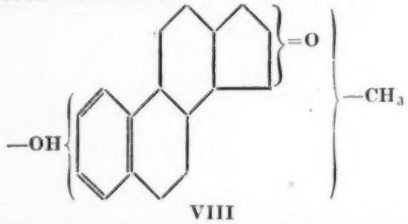


VI



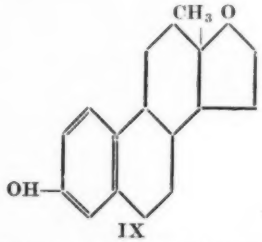
VII

The former authors preferred the skeleton V and postulated VII and VIII as alternatives for ketohydroxyœstrin. Later surface film work by Danielle *et al* clearly supported formula VIII.



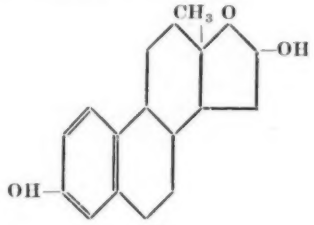
VIII

Simultaneous work on the constitution of sterols and bile acids by Rosenheim and King in 1932 suggested that a modified formula of the type of the chrysene skeleton III would explain the chemical and physical behaviour of the sterols and bile acids better than the old Wieland-Windaus formula. These views were adopted by Wieland and Windaus. This new formula for the sterols suggested the probable relation of the œstrins to the sterols and thus formula VII appeared much more probable. In fact, Butenandt went so far as to suggest IX and X



IX

for ketohydroxy and trihydroxyœstrin respectively. His arguments were criticised by Marrian as speculative but the most recent brilliant researches of Butenandt have proved that œstrins are chemically related to sterols.



X

One of the most remarkable recent developments in this subject is the synthetic work of Cook and Dodds who have produced a large number of œstrogenic substances. Among them are (1) 9 : 10-dihydroxy-9 : 10-di-n-butyl-9 : 10-dihydro-1 : 2 : 5 : 6 dibenzanthracene, (2) 1-keto-1 : 2 : 3 : 4-tetrahydrophenanthrene, (3) 5 : 6-cyclopenteno-1 : 2-benzanthracene, (4) 1 : 2-benzpyrene in descending order of potency. Two of these, *viz.*, 1 : 2 benzpyrene and 5 : 6-cyclopenteno-1 : 2-benzanthracene are also powerful carcinogenic agents. These results have opened a wide field of study. The fact that "the cell prolification which characterises the œstrus state is in some respects reminiscent of the early stages of malignant growth," as stated by Cook and Dodds, suggests that considerable light may be thrown on the whole problem of malignant growths. In view of the established relationship between the œstrins and the sterol group, it will be interesting to hear the results of Cook and Dodds investigations on the carcinogenic activity of 1 : 2-cyclopentenophenanthrene which may be regarded as the basic aromatic hydrocarbon of both the œstrins and sterols.

Letters to the Editor.

Dilatometric Investigations of the Tryptic Digestion of Proteins.

THE kinetics of the tryptic digestion of proteins can be conveniently followed in the two bulb dilatometer (*J. Indian Inst. Sci.*, **15A**, 17, 1932) from the very commencement of the reaction. The hydrolysis is generally accompanied by a considerable contraction in volume which, in the case of casein, amounts to nearly 21·5 c.mm. per gram of material digested in 1 per cent. concentration for 24 hours at 30°C. The volume change is proportional to the release of carboxyl or amino groups (see table and graph I) which are respectively estimated by Willstätter's titration and Van Slyke's gasometric method.

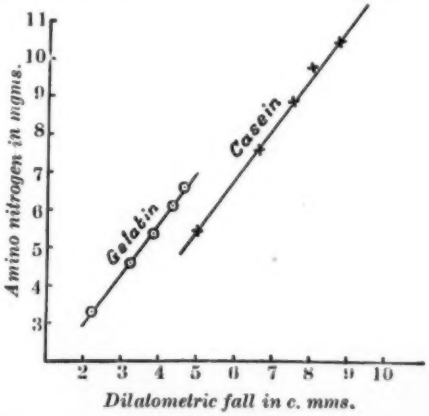
The tryptic hydrolysis of a 1 per cent. casein solution at P_H 7·7 gives a depression of about 12·3 c.mm. per milli mol. of NH_2 released during the hydrolysis, while gelatin under the same set of conditions, gives a contraction of about 9.7 c.mm. per milli mol. of NH_2. The volume change per milli mol. release of NH_2 appears to be characteristic of the structure and amino-acid make up of the protein.

The initial stages of tryptic digestion (during the first 30 mins.) appear to be accompanied by an interesting set of changes which are registered by the dilatometer but are not shown by a corresponding increase either in carboxyl or amino groups. There is, therefore, no linear relationship between the volume change and carboxyl release (see graph II) during the period.

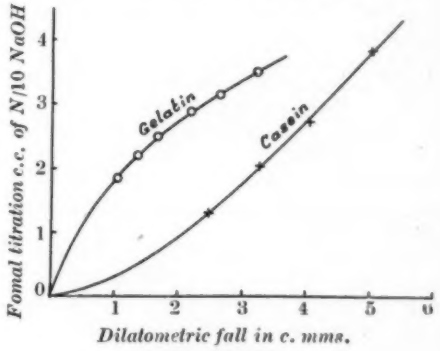
TABLE.

Substrate concentration, 1 per cent.: P_H of reaction mixture 7.7; Concentration of enzyme in reaction mixture, 0.09 per cent.

	Casein				Gelatin			
Time in mins.	30	60	90	120	30	60	90	120
Dilatometric depression in c.mm. ..	4·8	6·6	7·7	8·3	2·2	3·2	3·8	4·3
Amino nitrogen increase in mgms. ..	5·4	7·5	8·7	10·0	3·2	4·6	5·6	6·2



Graph I.



Graph II.

A study of the kinetics of the tryptic digestion of casein and gelatin reveals that casein is split up at approximately double the rate at which gelatin hydrolysis proceeds under comparable conditions. The dilatometer offers a very convenient method of studying the *in vitro* digestibility of various proteins.

By reason of the large change of volume accompanying the hydrolysis, the accuracy attainable by the dilatometric method is much greater than that usually obtained by the chemical methods. As the dilatometric column can be read with an accuracy of 0·5 mm. the error in measurement does not usually exceed 1·5 per cent. while

that involved in Van Slyke analysis is about 4 per cent.

M. SREENIVASAYA.
B. N. SASTRI.
H. B. SREERANGACHAR.

Department of Biochemistry,
Indian Institute of Science,
Bangalore,
July 3, 1933.

The Ground Terms and Ionisation Potential of Br II.

IN the course of investigation of the spark spectra of Bromine,* a careful examination of the plates taken with an amount of inductance just sufficient to elicit the lines of Br II and Br III strongly (while there is considerable suppression of the lines due to higher stages) revealed the following combinations between the deepest $4p\ ^3P$ and $5p\ ^5S$, $5p\ ^3S$ of Br II.

		$5p\ ^5S_2$	$5p\ ^3S_1$
		6908	
$4p\ ^3P_2$		101529 (20)	108436 (10)
	3058		
$^3P_1$		98470 (15)	105378 (10)
	1251		
$^3P_0$			104127 (10)

Besides the identical behaviour of the five lines under different experimental conditions, the following progression of the interval of the ground term convinces one of the correctness of the identification.

$$mp(^3P_2 - ^3P_1)$$

O I 158 F II 344 F II/O I = 2·18
S I 398 Cl II 696 Cl II/S I = 1·75
Se I 1988 Br II 3058 Br II/Se I = 1·54

The value of 3058 cm^{-1} obtained for the interval $4p(^3P_2 - ^3P_1)$ of Br II is thus quite satisfactory. An interesting feature to be noticed is that the intercombination lines $4p\ ^3P$–$5s\ ^5S$ are much stronger than the triplet–triplet combinations. This feature might be expected as these intercombination lines essentially form what are usually called the resonance lines. It is significant to observe here that the corresponding intercombination lines in the arc spectrum of selenium of the same row of the periodic table have been found in absorption by a column of the non-luminous vapour.†

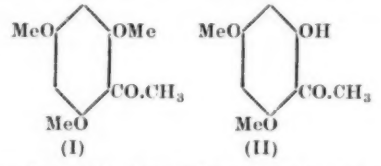
From the quintet system $5p\ ^3P$–$ms\ ^5S$, identified by Bloch, Bloch and Lacroute,‡ it has now been possible to obtain the deepest term $4p\ ^3P_2 = 183280\ cm^{-1}$, yielding a value of $22{\cdot}6v$ for the second ionisation potential of Bromine. The triplets identified by the above authors seem to be rather uncertain, due to the comparatively low intensity of the combination $5s\ ^3S_1$–$5p\ ^3P_1$. The author is indebted to Dr. K. R. Rao for placing the plates in the Schuman region, taken with the Siegbahn Vacuum Spectrograph at his disposal.

A. S. RAO.

Department of Physics,
University College of Science
and Technology,
Waltair,
July 3, 1933.

The Action of Aluminium Chloride on Polymethoxyflavones.

A HYDROXYL group in the 5-position in a flavone resembles the *ortho*-hydroxyl in a phenolic ketone in its resistance to methylation under ordinary conditions. It appeared probable that, conversely, a 5-methoxyl of a flavone may be as easy to demethylate as an *ortho*-methoxyl of a ketone. Phloracetophenone trimethyl ether (I) is converted into the dimethyl ether (II)

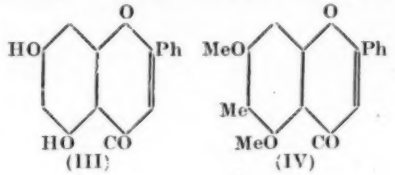


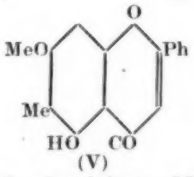
by heating with aluminium chloride at 110°.§ We have now found that, when a polymethoxyflavone is submitted to the action of aluminium chloride under specified conditions, demethylation takes place only in the 5-position and we are utilizing this observation for the synthesis of naturally occurring, partially methylated polyhydroxyflavones, such as wogonin, rhamnetin and rhamnazin.

* *Nature*, **131**, 170, 1933.

† Kimura, *Jap. J. Phy.*, p. 81, 1926-27.
‡ *Compt. Rend.*, **193**, 232, 1931.
§ Kostanecki and Tambor, *Ber.*, **32**, 2260, 1899.

The methylation of chrysin (III) in acetone solution with methyl sulphate and alkali yielded a substance whose melting point was different from that of the known dimethyl ether.* The analysis indicated a C-methyl chrysin dimethyl ether (IV) and





treatment with aluminium chloride led to a monomethyl ether (V), closely resembling tectochrysin in its colour reactions.

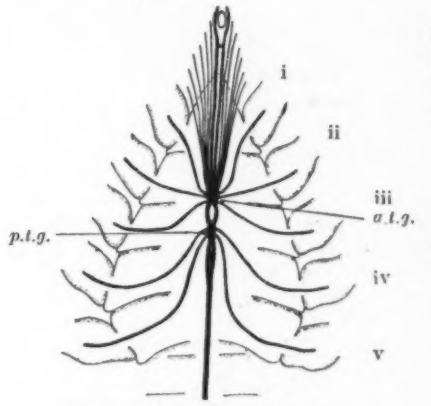
K. VENKATARAMAN.
G. K. BHARADWAJ.

Technical Chemistry Laboratories,
University of the Punjab,
Forman Christian College,
Lahore,
July 6, 1933.

The Nervous System of Panulirus.

THE thoracic part of the nervous system in the Bombay lobster *Panulirus* has been described in the text books as a single large ganglion formed by the fusion of eleven pairs of ganglia with an opening in the centre for the sternal artery to pass through. It is thus figured as a ganglionic ring sending out eleven pairs of nerves all round.

In April last Dr. C. J. George wrote to me from Poona and asked me to see if the ganglionic mass in the thorax was not really two distinct masses. From some dissections which he had occasion to see at Poona he suspected that the description in the text books was not correct. I dissected six specimens collected from Bombay and found that there were two distinct masses of fused ganglia connected together by the double nerve cord, one situated anterior and the other posterior to the descending sternal artery. The anterior thoracic mass gives rise to nine pairs of nerves and is therefore formed of nine pairs of united ganglia, three of the



Panulirus.—Nervous System.
a.t.g. Anterior thoracic ganglion.
p.t.g. Posterior thoracic ganglion.
i–v. Walking legs.

head and six of the thorax, while the posterior thoracic ganglionic mass gives rise to two pairs of nerves and is therefore made up of two pairs of thoracic ganglia. While the individual ganglia could be distinguished in the posterior mass such a clear demarcation is not seen in the anterior mass. A sketch of the system appended illustrates the structure.

M. J. PRESSWALLA.

Department of Biology,
Wilson College,
Bombay,
June 26, 1933.

References :

Powell and Kohiyar, "Lessons in Practical Biology for Indian Students," pp. 129-131 (1926).
Yeolekar and Samarth, "Panulirus or the Spiny Lobster of Bombay," p. 30 (1926).
Mullan, "Animal Types," p. 112 (1929).
Gideon, "An Introduction to Zoology," p. 43 (1930).

Notes on *Ficus indica* Linn., and Closely allied American Species—*Ficus laurifolia* Hort. et. Lam., and *Ficus anthelmintica* Martius.

Ficus glabrata HB & K., as noted in *Nov. Gen. et Sp.* II. 47, is a synonym of *Ficus anthelmintica* Martius. Miquel in Hooker's *Lon. Jour. of Botany* (1, 66, 1848) described

*Tasaki, *Acta Phytochim.*, 2, 119, 1925.

it as *Pharmacosycea anthelmintica*, growing as a fine large tree in the primeval forests of the province of Paraensis et Rio Negro in Brazil. Martius mentions about the vermicidal property of the latex of this species. *Ficus laurifolia* Hort., as noted in the *Dict. Ency. Metho. Bot.* Lamarck, (**2**, 495, 1790) is an American species and is very much allied to *Ficus indica* Linn., which is distributed, as noted in *Flora of British India* (**5**, 506, 1890) in Burma, Perak, Singapore, Andamans and Malay Archipelago. Kurz in his *Forest Flora of British Burma* (**2**, 442, 1877) reports frequent occurrence of *Ficus indica* in the forests from Martaban to Tenasserim. The writer during his recent explorations in these regions confirms Kurz's statement. It extends, as King remarks, up to Philippines. C. E. Parkinson mentions in his *A Forest Flora of the Andaman Islands*, p. 251, 1923, that *Ficus indica* Linn. is "at first epiphytic, often on Padauk or on *Mimusops littoralis*, and eventually forming an independent stem, often of enormous size". When the fruit is ripe in July and August, the tree becomes "the rendezvous of pigeons, minahs and birds of many other kinds".

As regards the systematic position of the two species, *Ficus anthelmintica*, as far as the descriptions go, may be put under the section II as a tree—Urostigma characterised by ♂ and ♀ gall flowers, all in one receptacle (monœcious) borne at the axils of leaves in pairs or rarely solitary with alternate, entire coriaceous or sub-coriaceous leaves. *Ficus indica* and *F. laurifolia* are also under the same section. Lamarck considers *F. laurifolia* as the next species to *F. indica*. None of these species appears to fit in any one of the other six sections of the genus *Ficus*, which is divided into seven broad sections of which Urostigma is the largest. The figures of *F. anthelmintica* and *F. indica* agree quite well. *Ficus laurifolia* again, as noted by Lamarck, is the nearest one to *F. indica* to which, as mentioned by Linneans and quoted by Hooker, includes numerous forms of the plants.

Thus, as far as the literature is concerned, taking into special consideration the monograph on the Indo-Malayan and Chinese *Ficus* by Sir G. King,* I am of opinion that *Ficus indica* Linn. may be considered as the closest species to those of *F. laurifolia* and *F. anthelmintica*. David Prain in his *Bengal Plants* (**2**, 979, 1903) considers Roxburgh's *Ficus indica* Amoen (*Flora Indica*, **3**, 539, 1874) a synonym of *Ficus Bengalensis* Linn. The vermicidal properties of the latex of *F. anthelmintica* indicate that *Ficus indica* may have similar properties. *F. indica* is allied to this species and it may be worth investigating the latex of the Indian species of *F. indica* Linn., or other allied *Ficus* species. The medicinal properties of the juice of *F. indica* are already recognized. "The genus *Ficus* yields a number of economic products. Many species possess a milky juice containing caoutchouc, as *F. elastica* Roxb., of Sumatra, etc. Some of the juices are employed externally as well as internally, as that of *F. indica* L. Some possess anthelmintic properties, as *F. anthelmintica* Mart. Some yield gum lac or shellac as a result of the puncture of an insect, as *F. religiosa* L., *F. laccifera* Roxb.; and some are esteemed for their fruits, as *F. carica* L., *F. religiosa* L., etc."† *Ficus indica* Linn. is available in the Royal Botanic Garden, Calcutta, and Botanic Gardens, Singapore.

K. BISWAS.

Herbarium,
Royal Botanic Garden,
Calcutta,
July 12, 1933.

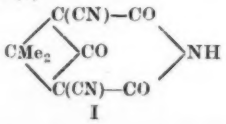
*George King, "The species of Ficus of the Indo-Malayan and Chinese Countries", *Annals of the Royal Botanic Garden*, Calcutta, Vol. I (1888).

†*The Dispensatory of the United States of America*, p. 1394 (1908).

Experiments on the Synthesis of Pinene: Synthesis of *Cis*-and *Trans*-ketonorpinic Acids.

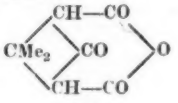
WORK has been in progress in this department for some time past to obtain pinene synthetically. An intermediate product of very great interest, *viz.*, ketonorpinic acid, has now been obtained, which should facilitate the synthesis of pinene.

The sodium derivative of Guareschi imide reacts with carbonyl bromide in the cold to yield, among other products, a satisfactory yield of $\alpha\gamma$-dicyano-$\beta\beta$-dimethyl-$\alpha\gamma$-carboglutarimide (I)

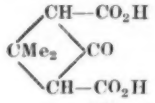


I

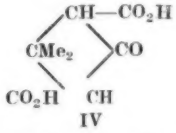
This on treatment with sulphuric acid at 105° for five hours gives the anhydride (II) and the *cis*-form of ketonorpinic acid (III), whereas, at 130° the *trans*-variety (IV) is obtained.



II

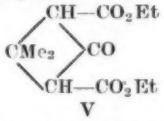


III



IV

The sodium derivative of ethyl acetonedicarboxylate in benzene suspension reacts with chloracetol when heated in a sealed vessel at high temperature to yield the diethyl ketonorpinate (V)



V

Constitution of this ester has been established by its conversion into the dicarboxylic acid (III) on hydrolysis with baryta.

This ester (V) with two active methylene groups in 1 : 3 positions should form a convenient starting material for the synthesis of pinene and allied products.

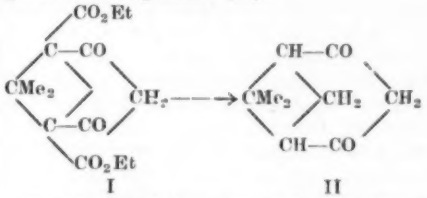
P. C. GUHA.
R. C. DAS GUPTA.

Department of Organic Chemistry,
Indian Institute of Science,
Bangalore,
July 31, 1933.

A New Method of Synthesis of Bicyclic Compounds.

THE attempts made by Guha and Patel (*J. Indian Inst. Sc.*, **15A**, 125, 1932) to effect bridge formation between the 1 : 4 carbon atoms in *cyclo*hexane-2 : 3-dione-1 : 4-dicarboxylic ester and by Guha and Mayuranathan (*Ibid.*, p. 131), between the 1 : 3 carbon atoms of Scheiber and Miesel's ester according to the conditions then employed were not successful.

We have now succeeded by a thorough modification of the experimental methods in effecting the desired bridge formations. The disodium derivative of Scheiber and Miesel's ester in benzene suspension reacts with methylene iodide when heated in a closed vessel at a high temperature to form the bridged ester (I) which on hydrolysis gives ketonopinone (II).



I II

Succinosuccinic ester under similar conditions yields the 1 : 4-bridged compound.

This novel method has wide possibilities of application to the synthesis of bicyclic compounds in the terpene class.

P. C. GUHA.
K. N. GAIND.
D. R. MEHTA.

Department of Organic Chemistry,
Indian Institute of Science,
Bangalore,
July 31, 1933.

Studies on the Life-History of *Limnophyton obtusifolium* (Miquel).

THE short note published by Mr. B. M. Johri in *Current Science*, **2**, 12, 1933, on the morphology of *L. obtusifolium* contains certain observations which differ fundamentally from those which I have been able to gather from my studies on the same plant. There does not appear to be any discrepancy regarding the identification of the material and therefore it is necessary for me to briefly mention here the points of difference.

1. *Embryo sac.*—Mr. Johri has described the embryo sac as possessing only six nuclei. In my studies I have come across embryo sacs containing all the eight nuclei in the early stages (Figs. 1 & 2). Probably the observations of Mr. Johri have been based upon the examination of fully organized embryo sacs where two of the antipodal nuclei have already degenerated. I may further add that the synergids possess a 'filiform apparatus'.

2. *Tapetum.*—In my preparations I find that the tapetum is parietal in origin and that there are no middle layers while Mr. Johri has described the sporogenous origin of the tapetum and the occurrence of middle layers. In later stages the tapetal cells are found to be wandering amidst the

developing pollen grains and they do not coalesce to form a true periplasmodium.

3. *Pollen grain.*—The mature pollen grain possesses, besides the tube nucleus, two distinct male cells which can be clearly made out by a distinct cytoplasmic sheath surrounding each male nucleus. This cytoplasmic sheath is quite different in appearance from the general cytoplasm of the pollen grain (Fig. 3). Therefore they are not mere male nuclei as has been described by Mr. Johri.

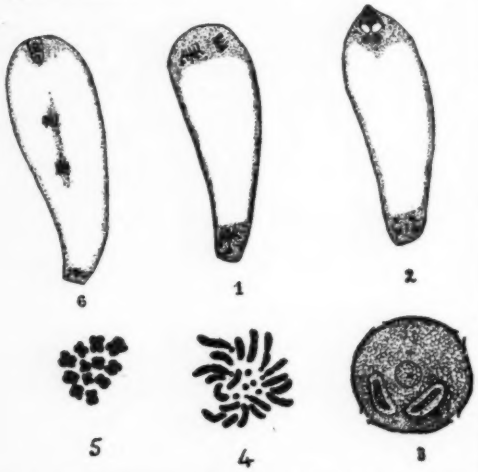


Fig. 1. × 660 app. Mitotic divisions in the embryo-sac; one of the nuclei at the chalazal end still undivided.

Fig. 2. × 900 app. Eight-nucleate embryo-sac which is not yet fully organised.

Fig. 3. × 900 app. A ripe pollen grain with a tube nucleus and two male cells.

Fig. 4. × 1,800. Polar view of the early anaphase of mitosis showing 24 chromosomes (diploid number). Satellites seen on 5 of them.

Fig. 5. × 1,800. Polar view of heterotypic metaphase showing 12 bivalents (haploid number).

Fig. 6. × 660 app. Abnormal polar fusion; each polar nucleus being fertilised by a generative nucleus.

Besides the above my detailed studies of the same plant both from cytological and morphological aspects have revealed the following interesting results :—

The chromosome number as determined both from the haploid and diploid generations is found to be 12 and 24 respectively (Figs. 5 & 4). The study of the somatic mitosis shows the origin and behaviour of the 'chromonema structure' of the chromosomes and the occurrence of constrictions and trabants (satellites) on the chromosomes (Fig. 4). The longitudinal split in the chromosome is found to take place in late prophase just before the arrangement of the chromosomes on the metaphase plate.

An abnormal case of fertilisation was noticed in which one of the generative nuclei was observed to fragment into two and each of them fused independently with the two polar nuclei (Fig. 6).

Regarding the embryogeny, the first longitudinal wall appears when the proembryo is five-celled. The fully formed embryo is horse-shoe shaped with practically no endosperm surrounding it.

I wish to express my deep sense of gratitude to Dr. M. A. Sampathkumaran, Professor of Botany, Central College, Bangalore, under whose guidance the work was carried out.

S. K. NARASIMHA MURTHI,
Department of Botany,
University of Mysore,
Bangalore,
August 1933.

Hydro-Electric Schemes in India.

IN the interesting note on hydro-electric schemes in India published in the July issue of *Current Science*, the author has omitted to draw attention to one feature—the electrical isolation of Mysore. With the development of systems on the North, South and West, all employing 50 cycles, Mysore with its 25 cycles may eventually become an island cut off from all co-operation with its neighbours. With the example of England before us and a knowledge of the vast sums recently expended in frequency standardization, should we not consider what can be done to save the situation ?

It may be argued that the case of England and of India is not the same and that Mysore is large enough to be self-contained. To take a few instances, however, what would be the position in the event of general railway electrification ? It is already almost impossible to purchase standard wireless apparatus for use on 25 cycle mains, may not this apply to electrical machinery in general before many years have elapsed ? What is the effect of 25 cycle illumination on the eyesight of villagers ? Any electrical engineer could add many more arguments of a technical nature and if the whole question is considered it seems almost certain that sooner or later conversion is bound to come.

On the other hand, we are told that this step is impossible on the ground of cost. One thing is certain, however, and that is, that the longer the matter is delayed the greater will be the cost. In spite of the cry "financial stringency", the present time is most opportune; machinery is cheap, and money, in the event of a loan being necessary, is also cheap. It is not for a layman to discuss details, but it appears to me that with a carefully planned progressive scheme, the expenditure might not be as great as appears likely at first sight. The Kolar load which is more than half the total must be regarded as temporary and might well be left alone. All new extensions might be supplied with frequency changers (and admittedly run at a loss for a while) and the change-over extended backwards until the cities of Bangalore and Mysore were reached. At this point the conversion would have to be a wholesale one both at the generating station and consumers' premises, but the power involved is comparatively small and there should be no great technical difficulty. It would be interesting to have the opinion of experts on this subject.

H. E. WATSON.
Indian Institute of Science,
Bangalore,
August 1933.

Disappearance of Colonies from Count Media.

THIS phenomenon was first reported by Subrahmanyan and Ganesha Rao (*J. Indian Inst. Sci.*, **12A**, 253, 1929) in the case of soil bacteria and confirmed independently by Corbet (*J. Rubber Research Inst., Malaya*, **3**, 7, 1931). Its nature and significance have so far remained obscure.

Quantitative studies of a number of soils and on a variety of biological media have shown the following:—(1) Colonies disappear from all the count media that have so far been devised. (2) The numbers that disappear vary with different soils and are, in some cases, as high as 15 per cent. of the final counts. (3) The colonies first appear in the early stages of incubation, generally within the first 3 days. In a short time they turn first translucent, then increasingly faint until they fade out altogether at the end of about a week. (4) It has not, so far, been possible to cultivate the disappearing organisms owing to the fact that they generally die out before the fading of the colonies can be observed.

Further study of the phenomenon is in progress to determine its significance in relation to (*a*) the accuracy of the present methods of enumerating different soil microorganisms, and (*b*) disintegration of microbial cells resulting in their ultimate transformation into plant nutrients.

R. RAJAGOPALAN.
Department of Biochemistry,
Indian Institute of Science,
Bangalore,
July 8, 1933.

A Note on Cyst-Formation in *Protosiphon botryoides* (Kutz.) Klebs.

THIS alga was collected from Bodal, District Hoshiarpur, Panjab, where it appeared in great abundance in fields lying fallow after the rains in October 1929. Patches of soil, often many yards in diameter, appeared like bright green carpets from a distance. The alga has a globular aerial portion with

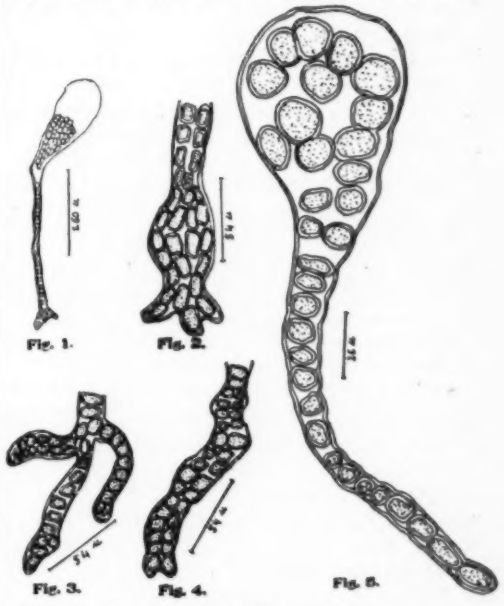


Fig. 1. An adult plant with cysts.
Fig. 2. A slightly branching rhizoid with swelling near the dichotomy.
Fig. 3. A clearly branching rhizoid.
Fig. 4. Biseriate cysts.
Fig. 5. A plant with mature cysts.

reticulate chloroplasts and numerous pyrenoids. The average size of the vesicle is about 130μ. The rhizoidal part is usually unbranched but in some cases it shows a clear dichotomy at the lower portion (Figs. 1–3).

A peculiar type of cyst-formation was observed in this alga. The process takes place simultaneously in the rhizoidal and aerial portions, the protoplasm being divided profusely into a number of rounded pieces and extensive wall-formation taking place. The result is the production of a number of red cysts, 18–20μ in diameter and with granular contents and thick lamellated walls (Fig. 5) which are very different from those figured by Oltmanns (Oltmanns 1904, p. 178, fig. 110) and Brunnthaler (Brunnthaler 1915, p. 87, fig. 45). In some cases the whole of the globular aerial portion is filled with cysts, and usually the cysts occur in a single row in the rhizoidal portion (Fig. 5), but two or even three irregular rows of cysts in this part are not uncommon (Figs. 2 & 4). The cysts are rounded in the aerial portion and rectangular in the rhizoidal portion due to compression of the rhizoidal walls. Very often the lower portion of certain rhizoids becomes distinctly swollen and has 3–4 series of cysts inside (Fig. 3). The peculiarity in cyst-formation, therefore, consists in the occasional multiseriate nature of the cysts, which is sometimes accompanied by a clear swelling near the dichotomy.

S. L. GHOSE.
M. S. RANDHAWA.

Department of Botany,
University of the Panjab, Lahore,
July 5, 1933.

References.

Brunnthaler, Jos. In Pascher's "Susswasser Flora, Deutschlands, Oesterreichs und der Schweiz. Heft 5, Chlorophyceæ II," 1915.

Oltmanns, Friedrich. *Morphologie und Biologie der Algen.* Band I. Jena (1904).

The Glacier.

I am born on the height, in the wintry night,
Of my misty mother the Cloud;
Wooed by the Earth, she dies giving birth,
And I, like a living shroud,

Spread my white form and am tossed by the storm
Against the breast of my sire;
While the thunder groans, and the whirlwind moans,
And the lightning flashes fire.

Soft and white, like a new-born sprite,
My infant way I grope,
Aimless and free—my road to the sea
No more than a hazard of slope:

For a shoulder of rock, or haply a block,
May govern the path of my motion;
A spur may frown and send me down
On my way to a different ocean.

Chased by the Wind, I hide behind
Some sheltering boss or hollow,
And laugh to spy him blundering by,
Safe tha' he cannot follow.

With a sudden sweep I plunge down the steep,
And then the mighty hush
Of slumbering crag and pinnacled jag
Is rent by my thunderous rush.

From islets serene and dells of green
The Gentian and Alpine Rose
Open their eyes in smiling surprise
At the depth of my chilly snows.

I harden and grow, as I pass below
With my burden of fallen blocks,
Which, seized in the vice of my sinews of ice,
Chisel my bed in the rocks.

Circling around the hummocky ground,
I am sprawling half-asleep;
Or over the edge of a dizzy ledge,
Reckless, I madly leap.

And wherever a crack has rent my back,
From my crystal deeps are wrung
Soft shadows new and shafts as blue
As the sky from which I sprung.

When the breathless spell of the flaming farewell
Of dead Day fades before me,
As she follows his hearse, Night stoops like a nurse
To fling her mantle o'er me.

But the Moon will arise and steal from the skies
To pluck the mantle aside,
And awake with the blaze of her silver rays
The glory my crevices hide.

And when she retires with her dulcet fires,
The sombre dark I leaven,
Reflecting sweet bars of light from the stars
That bejewel the bowl of Heaven.

The morning Sun wakes me to fun,
As he pierces the Earth's blue rafter;
I flash in my strength, but dissolve at length
Into streams of gurgling laughter.

E. H. P.

The Industrial Outlook.

Industrialising India.*

WE had occasion to review in our columns[1] the thoughtful contribution of Sir M. Visvesvaraya to the problem of Unemployment in India. The present publication is a continuation of the above with some definite suggestions regarding the lines of action to be taken by the Government and others interested in the industrial development of the country. In his introductory remarks the author lays stress on the fact that industrialisation will be the sole means of relieving the increasing unemployment, raising the status of the people and restoring the prosperity of the country. Although agriculture is the basic industry of the human race, yet it has always been a precarious means of livelihood, so that if the country is to prosper the pressure on the land should be reduced without impairing the efficiency of agricultural production. The Government as well as the members of the public should direct their attention to the development of industries, which alone would contribute materially to the prosperity of the country.

In recent years, the Indian export of finished articles has greatly diminished while imports of similar materials from abroad has considerably increased. The small favourable trade balance, which is also steadily diminishing, is largely due to increase in the exports of raw materials, a position which, in the eyes of experienced critics, is not likely to be maintained very long. Various parts of the world, hitherto undeveloped, are now producing increasing quantities of grains and food articles, so that, before long, we may be faced with a situation in which we will be the exporters of neither raw materials nor finished articles.

After classifying the possible new industries under three main heads—large, medium and small[2]—the author proceeds to discuss the nature of the structure that is immediately needed for their development. There should be (1) a general organisation composed of representatives of Government and business men who, by mutual co-operation, would maintain the atmosphere favourable to the rapid growth of industries, (2) local organisations such as councils in cities and rural areas for promoting industries suited for the particular localities, (3) adequate tariff protection for such industries as need them, (4) banking facilities, (5) provision of statistical information, and (6) proper legislation regarding the Companies Act and managing agency system so that the public may develop confidence and business will attract the necessary capital. The industrial sense of the country may be further developed by holding exhibitions and organising commercial museums and demonstration stations, encouraging industrial research, imparting technical education and arranging for easy transport facilities.

The present conditions in India are highly discouraging. Millions of people in rural areas live in abject poverty and tens of thousands of graduates and educated men roam about the country in search of employment. The only possible way of maintaining the rapidly increasing millions of India in a moderate state of comfort is to adopt a policy of rapid industrialisation. The programme of development during the next few years has to be carefully planned and energetically carried out. If left to the chances of natural growth under existing abnormal conditions it is impossible to expect any real progress. It is, therefore, absolutely necessary for those in authority to adopt immediate and effective measures for checking the present drift towards ruralisation and take steps to attract the best talents of the country—which are rusting through neglect—to work out a scheme of industrial development.

The country owes a deep debt of gratitude to the veteran statesman who, in spite of his declining years, is still one of the foremost in the cause of public service. Sir Visvesvaraya has no doubt given much thought to the details of many of the industries that he has referred to in the course of his several public addresses and it will be highly stimulating both to those engaged in the promotion of industries and to the members of the public if he could further develop some of his themes and show precisely how certain specific industries can be safely

---

* *Industrialising India: Constructive Policies and Plan*, by Sir M. Visvesvaraya, K.C.I.E., LL.D. An address delivered before the Mysore Chamber of Commerce on the 10th July 1933. The Bangalore Press, Bangalore. Price As. 12.

[1] "Unemployment in India," *Curr. Sci.*, **1**, 93, 1932.

[2] *Vide Curr. Sci.*, **1**, 95, 1932.

developed in certain parts of the country. Attention may also be drawn to the fact that side by side with the development of new industries, the produce from land should also be increased. We may even venture to suggest that the new industries are more likely to succeed if they involve the utilisation of surplus agricultural produce—wherein there is yet no danger of foreign competition—and cheap labour, which is plentifully available, rather than if they require the importance of either raw materials or expensive machinery from abroad.

The Future of the Sugar Industry.

IT is rather unfortunate that the Conference held recently* at Simla did not lead to any definition of policy that would materially help the cause of the sugar industry in the country. There was ample scope for the free exchange of views, but the delegates could not arrive at any unanimous decision regarding any one of the items on the agenda. The Central Government, quite wisely, sought the necessary guidance from the experience of the Provincial representatives, but the latter were unfortunately so circumscribed that they could not view the problem as an all-India question. The Conference thus ended the delegates parting with the satisfaction that they had an opportunity to understand each other's views and plans.

The Conference was convened by the Government of India to consider whether (1) the present rate of development of the sugar industry is satisfactory, (2) the protection has unduly benefited the manufacturers at the expense of the consumers, (3) the benefits of protection are being adequately distributed between the cane growers and the sugar manufacturers, (4) the interests of the industry will be best served by zoning of areas, licensing factories, fixation of cane prices or other means, and (5) any legislation is needed to regulate the Indian sugar industry and, if so, to what extent the necessary action should be taken by the Central or the Provincial Governments.

The proceedings of the Conference may be summed up as follows:—The chairman (Mian Sir Fazl-i-Hussain) welcomed the delegates in a short and felicitous speech and placed the problems at issue before the meeting. The discussion on the present position of the sugar industry elicited diverse opinions, the provinces which had already made some headway viewing further expansion with disfavour while the others, less fortunate, pleaded for the erection of more factories. A resolution expressing satisfaction with the present progress and viewing further production of white sugar as being detrimental to the interests of raw sugar (*gur*) manufacture was passed by a majority, but was rescinded at a later stage. Considerable amount of time was devoted to the discussion as to whether any legislation was needed to regulate the nature of the relation between the growers and the manufacturers. Some of the provinces were for the zoning of the areas and regulation of the cane prices while the others were either opposed to such an arrangement or had no experience of the problem. A small committee was appointed to go into the question, but their findings were ignored as a 'private report', so that although the United Provinces is already faced with the difficult problem of having to adjust the relation between over thirty factories and the growers, no useful line of action could be agreed upon. Some time was devoted to a discussion of the problem of utilisation of molasses, but a resolution sponsored by twenty members requesting that (*a*) sugar manufacturers be permitted to produce power alcohol from waste molasses and sell it for use in India and abroad, and (*b*) petrol companies in India be made to sell liquid fuel containing 30 per cent alcohol was disallowed by the chairman. The Conference thus terminated having reached no decision regarding any of the points at issue.

It is indeed regrettable that the Conference could not view the problems in their proper perspective and arrive at decisions which would not only ease the present situation but also avert possible difficulties which would arise in the future when the protective tariff is withdrawn. Any one interested in the stabilisation of a prosperous sugar industry in the country should take the following facts into consideration:—(1) All provinces of the country are not equally well adapted for growing sugarcane in an intensive manner that would facilitate a large-scale production of the sugar at rates that would defy competition from other parts of the world. (2) In certain parts of the country, particularly in regions which are far away from the coast and situated at considerable distances from the

* 10th to 12th July 1933.

more intense sugarcane areas, it may still be possible to produce sugar at competitive rates owing to the heavy cost of transit from one part of the country to the other. (3) In all civilised countries the consumption of sugar per head of population has greatly increased during the past few decades. It is not improbable, therefore, that with a more liberal supply of sugar and with increasing general prosperity, the Indian consumption may become doubled or even trebled during the next half century. (4) Although raw sugar has certain good qualities and appeals to a particular type of palate, yet even in orthodox circles it is now being steadily displaced by the cleaner and better-keeping white sugar. The sentiment against the use of bone charcoal is steadily weakening and with the introduction of new and more active types of charcoals of vegetable origin even the little objection which now exists against white sugar will soon disappear. (5) The process of refining raw sugar is at present somewhat expensive and wasteful, but with improvement in the technique it should be possible to convert it into a paying industry. In other words, even in localities where cane growing is somewhat scattered it may soon be possible to collect all the raw sugar and convert it into the white, crystalline product. (6) The problem of utilisation of molasses is already assuming serious proportions. Unless some new use such as conversion into crystalline sugar or edible sugar syrups is developed, manufacture of power alcohol would be the only satisfactory method of utilising the large quantities that would be turned out every year by the numerous sugar factories in the country.

Reviewing the present position in the light of the above facts, it would be seen that the cultivation of sugarcane, as also the manufacture of white sugar, will always be more intense and more paying in certain parts of the country (*e.g.*, a large stretch of the Indo-Gangetic plain) than in others. There are also fairly big patches in other parts of the country where sugar can always be produced on a competitive basis. Some of these areas are situated far inland (*e.g.*, Mysore), so that with the additional protection imposed by the high cost of transit they could always defy foreign or other internal competition. It should, at the same time, be admitted that there are several other tracts in the country where cane is now being grown and factories are either already operating or on the point of doing so, where the industry will either not pay or will bring in a useful return only so long as the present protective tariff prevails. It would follow, therefore, that the Central and the Provincial Governments should actively co-operate in encouraging areas where the conditions will always be favourable for profitable manufacture of sugar and discourage others where the investors are eventually likely to fail. It is no doubt true that it will be difficult to arrive at correct estimates of the cost of production of sugar in different parts of the country and the possible extent to which they could eventually compete on the basis of free trade, but judging from the average yield of cane and the general factory conditions, it should be possible for a competent committee of experts to arrive at useful working estimates for different localities which would serve for the guidance of the Government or the information of the public. The success of several North Indian factories has inspired a certain amount of confidence in the sugar industry and large amount of capital is flowing unreservedly even into areas where the industry will not pay. The public should, therefore, be given the necessary authentic information so that they would be properly guided in their investments on new ventures.

The future of white sugar in relation to *gur* will largely be determined by public taste. There is already evidence of increasing favour for the white sugar and if the conditions prevailing in certain Western countries like Great Britain could be taken as the standard, one may reasonably expect that white sugar will soon almost entirely displace the raw product.

With regard to the total consumption of sugar, the experience of different parts of the world would point to its being definitely on the increase. India could be no exception to the rapidly developing "sweet tooth" so that this tendency combined with the possible preference for the white sugar will hold out a highly hopeful future for the sugar industry.

It is no doubt true that a pampered and well-protected industry may (*sic*) take its own terms both to the growers and to the consumers. With a view to ensuring fair deal to the latter, the Central and the Provincial Governments can maintain competent standing committees that can determine (*a*) the minimum price to be paid to cane in each locality, and (*b*) the maximum

price that should be paid by the consumer in any part of the country. At the same time, with a view to reducing the risk of excessive internal competition, the Central Government may legislate offering a useful bounty on sugar exported abroad. In this manner not only will there be fair deal all round but by the adoption of a watchful policy the Government will also be stabilising an industry which the protective tariff has now helped to create. At their end the manufacturers should also organise their efforts both for increasing the popularity of sugar as an article of food and for establishing a useful export trade.

It has already been mentioned that the process of sugar refining as at present practised, is not paying except for the manufacturer of sugar of the highest type of purity for which there is only a limited demand. Since the establishment of refineries will be the only workable means of manufacturing white sugar in certain parts of the country where cane is scattered, it may therefore be necessary to initiate researches with a view to simplifying the process of refining so that raw sugar can be converted into white product at moderate cost. The Central Government should encourage the necessary scientific investigations by subsidising them and offering attractive prizes for new and workable methods.

The problem of utilisation of molasses is engaging the attention of scientists all over the world, but so far only the manufacture of power alcohol has proved to be the most satisfactory method of converting that by-product into an article of commerce. The fermentation of molasses to alcohol is now a fairly well standardised process and yields of about 90 per cent. of the theoretical amount of alcohol may be reasonably expected from well-managed distilleries. Two essential points for success of the manufacture are that the process should be continuous and that the energy spent on the distillation of alcohol should be reduced to a minimum. There are now a few good types of fermenting and distilling plants on the market and with proper technical control it should be possible to make the process a success. Alcohol of nearly absolute purity is miscible with petrol in all proportions and, as suggested by several of the representatives at the recent Conference, all internal combustion engines designed to run on pure petrol can work, with at least the same efficiency, on liquid fuel containing 30 per cent. of alcohol and 70 of petrol. In addition to the above, alcohol is the basic material for a number of chemical manufactures and pharmaceutical preparations, so that, with an abundant supply of cheap alcohol, there will be a great stimulus to various other industries in the country.

It should be admitted, however, that the excise control of the manufacture of alcohol by private factories is highly difficult. It may, therefore, be suggested that the manufacture of alcohol from molasses be established as a separate industry managed or adequately supervised by the State. The distilling company can then buy the molasses at scheduled rates from the sugar factories in the neighbourhood and manufacture the alcohol. The size of the fermenting and the distilling plants would depend on the amount of molasses available in the district. The alcohol thus produced can, at any rate for the present, be distributed directly under State supervision. Admixture with petrol may be carried out at the big provincial stores and the new liquid fuel supplied as such, to the retail dealers who, in turn, will sell it to the consumers. In this manner, both the misuse of alcohol as such and the possible further adulteration of petrol with alcohol can be avoided.

It is not improbable that there may be a certain amount of misgiving in the minds of the petrol manufacturers that the consumption of their product will be reduced to the extent to which alcohol is added. But such need not necessarily be the case. The abundant supply of cheap fuel will in fact stimulate increased consumption of the new petrol by automobiles and as also various industries. Moreover, petroleum has several valuable properties which could not be easily displaced by alcohol so that there is no need to apprehend the future of the oil mining industry.

Other possible uses of molasses would relate to either its conversion to clean sugar syrup, manufacture of animal feeds or utilisation as manure for sugarcane and other crops as is now being done in other countries. It is no doubt true that molasses contains the major part of the minerals taken up by the cane during its life, but the sugar present along with it will be largely wasted in the soil. It is possible that under highly favourable conditions the molasses will help the soil to fix the nitrogen of the atmosphere, but, more often than not,

injudicious application of molasses either as such or with diluted water to the soil would lead to profuse growth of fungi, which would not only lead to soil sickness but also perhaps attack the cane growing thereon.

In the foregoing columns we have only outlined some of the more important problems that now face the sugar industry in the country. Factories are springing up everywhere at a rapid rate and it is not unlikely that, before long, some of the problems may become highly acute. It is suggested, therefore, that while conditions are still favourable the Government should take the initiative in the matter and appoint a competent committee to go into the above and related problems and advise them with regard to the best means of dealing with them. It is not too much to hope that by the adoption of such a wise and far-sighted policy, India will not only have stable sugar industry of her own, but will also, before long, be one of the foremost sugar exporting countries of the World.

Research Notes.

Peach Yellows and Sandal Spike.

IN a recent paper (*Contrib. Boyce Thompson Ins.*, **5**, 19, 1933) Dr. L. O. Kunkel shows that peach yellows is transmitted by the leafhopper *Macropsis trimaculata*, and not by several other suctorial insects with which transmission experiments were tried. The obvious inference is that *M. trimaculata* is the specific vector of peach yellows.

This result is of considerable interest as the vector of this virus disease, like that of sandal spike, has eluded prolonged investigation. Moreover, with sandal spike, peach yellows was at one time regarded as being due to unbalanced sap circulation, a theory which continued in certain quarters because the vectors of these diseases were unknown. The case of peach yellows has also been cited as an argument against the hypothesis (Dover, *Ind. For. Rec.*, **17**, 1, 1932) that sandal spike is transmitted by a specific suctorial vector belonging to the Jassidæ, in which group the vectors of other yellows diseases, such as Aster yellows, are included. It was said that "The fact that other diseases are carried by sap-sucking insects does not form a sound argument for extending the analogy to spike-disease. There are several diseases of the virus group, in fact, which have not been transmitted by sucking insects. Peach yellows and peach rosette are typical instances in point." According to Quanjer (*Phytopathology*, **21**, 577, 1931), however, the yellows diseases are characterized by the fact that they are transmitted only by grafting and by specific suctorial vectors (never by mechanical sap inoculation), peach yellows and sandal spike being regarded as exceptions to the rule, as they had been transmitted by grafting but not by insects. Dr. Kunkel's work, therefore, not only definitely identifies peach yellows with the other yellows diseases, but provides indirect support for the contention that a specific suctorial vector is also responsible for the transmission of sandal spike, the remaining exception in the yellows group of viroses.

The success which has attended Dr. Kunkel's studies on peach yellows, and his work on other yellows diseases, should provide much encouragement and inspiration for those engaged on the problem of sandal spike. Patience and a critical attack have conquered the most elusive problems offered by virus diseases, and there is every reason to suppose that the sandal spike problem is susceptible to the same approach. In fact the information already available suggests that it will not be long before the cause of sandal spike is positively determined.

CEDRIC DOVER.

The Origin of Granite Magmas.

THE recent paper by P. Eskola (*Miner. und Petrogr. Mitteil*, **12**, Nos. 5 and 6, 1932) forms an important contribution towards the solution of the controversial problem of the origin of granitic magmas. From his intimate knowledge of pre-Cambrian massifs, he discusses the possibility of reconciling the two apparently opposed facts—"the downward increase in the amount of granite in the upper parts of the earth's crust and the downward increase of basicity in the globe as a whole." His conclusions may be briefly summarised as follows: "(1) The sial crust (*a*) originated mainly by crystallization-differentiation allied with partial

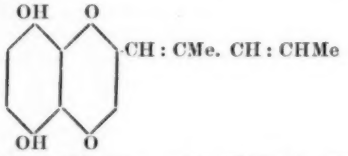
(selective) re-fusion and squeezing out of substance from older rocks and (*b*) has gradually thickened during geological ages. (2) The downward increase in the amount of granite is due to its magma-tectonic origin—the magma originating in the roots of orogens and for the most part, solidifying there ; whereas the reduced amount of granite near surface is due to the rise of basic material into the upper zones of the orogens, and to large-scale intrusions of basic lava in the kratogens." Eskola does not believe that a granite could originate from a basic silicate magma like that of plateau basalt by a process of crystallization-differentiation, as suggested by Holmes. Eskola's considered opinion on the problem of the origin of magmas is that " in the formation of the Earth's lithosphere, differentiation (preferentially by the squeezing out of fluid from crystal mesh) was most effective in the earliest stages, whereas palingenesis may have played a more important rôle during the later orogenic periods."

A New Constitutional Formula for Alkannin.

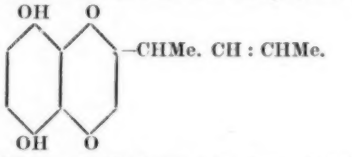
ALTHOUGH attempts have been made since 1833 to study the composition and constitution of alkannin—the important colouring principle of alkanet root—sufficient reliable data which would indicate to a correct formula are yet wanting. Its composition has been given by various investigators, as $C_{17}H_{10}O_4$, $C_{35}H_{20}O_8$, $C_{15}H_{15}O_4$, $C_{15}H_{12}O_4$ and $C_{30}H_{28}O_8$.

M. V. Betrabet and G. C. Chakravarti (*Proc. Ind. Sci. Cong.*, 1930, p. 181 ; 1931, p. 166 ; *J. Indian Inst. Sci.*, **16A**, pt. 4, 41, 1933) have suggested a new formula for alkannin. Unlike the previous workers, they subjected alkannin to an exhaustive purification through its acetyl derivative and gave $C_{15}H_{13}O_4$ as the empirical formula. Molecular weight determinations showed that the actual formula was double that of the empirical one and was $C_{30}H_{26}O_8$. The formation of a tetra acetyl-, tetra-benzoyl-, dimethoxy-, dimethoxy-dibenzoyl-, and dicarbethoxy-, derivatives showed definitely the presence of four hydroxyl groups —two phenolic and two alcoholic. Oxidation experiments yielded oxalic and succinic acids along with two nitro-compounds and a neutral body. Distillation with zinc dust gave β-methyl-anthracene.

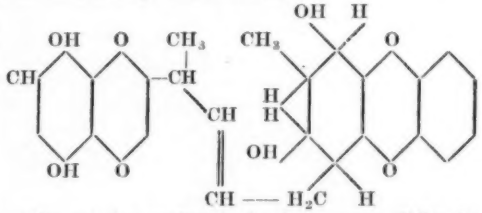
From the molecular weight of a tetra-acetylleuco-alkannin and from the formation of naphthazarin on distillation of alkannin *in vacuo*, Raudnitz, Redlich and Fiedler (*Ber.*, **64**, 1835, 1931 ; *cf.* Raudnitz, *ibid.*, **65**, 159, 1932) suggested $C_{16}H_{14}O_4$ as the molecular formula having the following constitution :



Dieterle, Salomon and Nosseck (*Ibid.*, **64**, 2086, 1931) ozonised alkannin in chloroform and got a dihydroxynaphthaquinone-dicarboxylic acid. They assigned $C_{15}H_{14}O_4$ as the formula with the following structure :



Betrabet and Chakravarti (*loc. cit.*) have correlated the whole data and suggested the following constitution :



Big as the molecule is, it is very difficult to say that this is *the* constitution. A larger number of degradation products have to be studied. The authors say that further experiments on these lines are in progress. The results of these investigations should be very welcome to "structural chemists".

Anisotropies in Paramagnetic Crystals.

IN continuation of the work briefly described in a previous issue of this Journal (*Curr. Sci.*, **1**, 239, 1933) Krishnan, Chakravarty and Banerjee have extended their investigation to paramagnetic crystals, and in *Phil. Trans. Roy. Soc.*, **A 232**, 99, 1933, they give a detailed report of the results of measurement on a large number of paramagnetic sulphates and double sulphates. The measurements seek to remove the discrepancies between various observers. The work of Jackson

(*Phil. Trans.*, **224**, 1, 1924; **226**, 107, 1927) is discussed in detail and some errors introduced by neglecting the signs of the couples acting on the crystal cylinders employed by Jackson are corrected. Details of the method employed by the authors are given; in the main the method is similar to that used by them in the case of diamagnetic crystals. A comparison of their results with those of others is also given. Among the crystals studied manganese ammonium sulphate was found to have the smallest anisotropy; the smallness of anisotropy is in agreement with what is to be expected from theory. Further work on the variation of the susceptibilities of some of the crystals at low temperatures is also reported to be in progress.

Unit Characters in Fossils.

IN a recent number of the *Proceedings of the Cambridge Philosophical Society*, **7**, 4, 1933, H. H. Swinnerton has published a paper on what he calls the "unit characters" in fossils. He mentions that the palæontologist can often trace such a "unit character" in any particular group of fossil organisms through successive periods of time, and as such he finds it of great value in working out evolutionary series. "The peculiarities of the unit characters are: (1) the unit character undergoes serial change, both in development and evolution, (2) serial change in development is parallel to that in evolution, (3) the time of onset of a character and of its successive phases of change varies in different individuals and changes progressively in successive communities, (4) the rate of change in expression of a character varies in different individuals, but becomes progressively more rapid in successively later communities, (5) unit characters behave independently of one another."

The Feeding Mechanism of Branchiopoda.

PROF. H. G. CANNON in an interesting paper (*Phil. Trans.*, **B. 222**, 1933) describes the feeding mechanism in the four orders—Anostraca, Lipostraca, Cladocera, Conchostraca and Notostraca of the sub-class Branchiopoda. The order Lipostraca is particularly interesting since it is only represented by a fossil form Lepidocaris. According to Prof. Cannon, from a structure like the gnathobase of Lepidocaris, the gnathobases of all the orders enumerated above except Notostraca, could be derived. In describing the possible line of evolution of the filtering trunk limbs in the five orders, he points out how in the original Branchiopod the anteriorly directed food stream developed secondarily and therefore it is not an effective mechanism. Consequent on the increase in the size of particles and decrease in the effect of suctions, the basal endites become modified along two lines, into structures of greater efficiency. On the one hand the Notostracan apparatus with endites projecting forwards and with no food grooves was evolved, while on the other, an apparatus with endites projecting backwards was formed in Anostraca, Cladocera, Conchostraca and Lipostraca. In these latter groups, filter setæ were developed and therefore the endites functioned both as food procuring and filtering agents. These are called siniognathobases. Further Prof. Cannon points out that the proper functioning of the Branchiopod phyllopodium (or the ultimate filtering limb) depends on the backwardly projecting exites, endopodites and endites from the thickened corm. He suggests that together with the body wall at the base, the shape of the limb is that of the bath and therefore the word 'droitopod' may be substituted.

The Study of Golgi Elements.

LAURA J. NAHM (*Journal of Morphology*, **54**, 2, 259, 1933) arrives at some very interesting conclusions believed to be of value in at least a partial clarification of the confusion which exists among modern investigators concerning the morphology, chemical composition and the functional significance of golgi elements and her results are not in accord with the existing theories of morphology and functional significance of the golgi apparatus. The golgi elements of fixed cells and the neutral red vacuoles of vitally stained cells are not constant morphological cell constituents but are the visible products of chemical reactions that occur in the cell. Neutral red reactions in the gland cells of a number of vertebrates show that the neutral red is not a specific stain and the capacity to stain with this vital stain depends on the kind and physiological state of the cell and the presence of acidic substances. The capacity to reduce osmic acid is not a specific property of any morphological element of the cell. The impregnation of salts is conditioned

by the chemical constituents of the protoplasm and vary with the quality of initial fixation and temperature of incubation. The materials that give rise to the so-called golgi are probably unsaturated fatty acids which may be present in cells at the time of fixation or may be formed during the process of impregnation from materials which were present in the living cells.

Basophil (Mast) Cells in the Alimentary Canal of Salmonoid Fishes.

LLOYD L. BOLTON (*Journal of Morphology*, **54**, 3, 549, 1933) has described basophil (mast) granule cells in the connective tissue throughout all the regions of the alimentary canal of Salmonoid fishes. Various theories and problems arising from the consideration of these cells have been briefly reviewed. The granule-bearing cells are mostly basophilic. Since their origin is traced to a more or less mesenchymal type of cell, it is contended that they are to be interpreted as connective tissue mast cells. The author finds no support to the suggestion that these cells are of the nature of secretory leucocytes and their presence in the tissue of the alimentary tract is without reference to the functional activity of the digestive canal. Further the mast cells do not show any obvious morphological change to be synchronised with the variations in the functional conditions of the tract. Their enormous number and the remarkable uniformity of appearance under varying conditions suggest that they may be degenerative cells with a probable function related to food storage. The mast cells exhibit amœboid movements and are found commonly between the crypts of the glands of the stomach and come into close relationship with the gland cells. The spherical granules contained are not lipoid in nature as they are not preserved by osmic acid and a protein composition is suggested as they are readily preserved by mercuric chloride. In living cells the granules are probably fluid and are interpreted as histogeneous mast cells.

Dahlia Diseases.

AMONG the valuable contributions of the Boyce Thompson Institute (**5**, No. 2), Philip Brierley's comprehensive study of Dahlia Diseases will greatly interest those interested in virus diseases of plants. Dahlia mosaic is suspected to be widely distributed and all the members of the genus *Dahlia* tested have proved susceptible but no suspects have been found outside this genus.

The symptoms of the mosaic are chlorotic bands following the veins, leaf distortion, shortening of internodes and flower stems and vein necrosis. Great variation appears in the reactions of different varieties, the more tolerant varieties showing only chlorotic symptoms. The disease is not known to disseminate through seeds, nor has the virus been transmitted by mechanical methods. Grafting, however, is a successful means of disease transmission and the diverse symptoms exhibited by tolerant and intolerant varieties are merely varietal reactions to one mosaic.

Myzus persicæ has been shown to be a vector of dahlia mosaic; other insects, experimented with, have so far not been able to transmit the virus.

The interval between infection and manifestation of symptoms is usually four to six weeks, but in some cases much longer. Late season infections in particular tend to show symptoms after a long interval, often not until the following season. The expression of symptoms in mosaic plants is often delayed in early season growth. The chlorotic symptoms of mosaic are frequently masked during the growing season. It is suggested that masking is determined by growth relations rather than by any single environmental factor.

Dahlia is not a preferred food plant of *Myzus persicæ* in early summer. Limited evidence suggests that some infections take place in July, and that more occur in September and October.

The rate of spread of mosaic in the field has been found to be of the order of 10 to 25 per cent. per year at Yonkers and New York.

Control of mosaic by selection and isolation of disease-free plants, supplemented by control of aphids during the period of greenhouse propagation and roguing, is recommended. Tolerant varieties affected with mosaic should be segregated from the healthy stocks, if grown at all.

Dahlia ring-spot is generally distributed in Connecticut, New Jersey, and southern New York, but has been found in high percentages in a few localities only. This disease has been transferred by grafting but

not by mechanical methods. The relation of ring-spot to mosaic is discussed.

Yellow ring-spot, seen only in dahlias received from Utah, has been transmitted by grafting but not by mechanical methods.

Oakleaf is tentatively described as a fourth virus disease of dahlia solely on the basis of symptoms expressed. None of the four virus diseases of dahlia, described in the paper, has been connected with other known virus diseases.

A New Blood Fluke from an Indian Tortoise, *Trionyx gangeticus*.

IN the *Journal of Helminthology* (Vol. XI, pp. 163–68) Dr. G. S. Thapar describes a new genus of blood flukes from an Indian tortoise from Lucknow. The genus is named *Trematorhynchus* and belongs to the sub-family *Hapalotreminæ* Stunkard, 1921. Several forms have already been described from the tortoises in the West under two genera *Hapalotrema* and *Hapalorhynchus*, but this is the first record of the occurrence of the hermaphroditic blood flukes from India belonging to this sub-family. The author describes its anatomy in detail and concludes with a discussion on the systematic position of the new genus. The genus is interesting in several ways, particularly so because it shows its affinities with both of the known genera of the sub-family *Hapalotreminæ* and thus serves as a sort of connecting link between them.

Spermatogenesis of *Gecko japonicus*.

SU-HSUEN WU (*Journal of Morphology*, **54**, 3, 593, 1933) in his study of the Spermatogenesis of the *Gecko japonicus* offers evidence in favour of telosynapsis and the duality of the chromosomes from synizesis to diplotene is the result of a longitudinal split in the chromosomes joined end to end. There are twenty tetrads in diakinesis and the chromosomes assume a rod-shape at metaphase. The movements of the chromosomes in the first division which is the reducing division are not synchronous. There is no interphase between the first and second divisions and the movements of the chromosomes in the latter division are synchronous. An unequal pair of chromosomes (heterochromosomes) is found in early metaphase and generally lags behind the others forming the equatorial plate. The haploid number is 20.

Science News.

The celebration of the Centenary of the Entomological Society of London on the 3rd, 4th and 5th May was marked by the announcement that His Majesty has been graciously pleased to grant the Society the privilege of being henceforth known as the Royal Entomological Society of London.

The Entomological Society was founded on May 3, 1833, when a few British naturalists met in J. G. Children's rooms in the British Museum, Bloomsbury.

The Centenary celebration included a first class display of modern entomological exhibits together with interesting volumes of the Society's library which included hand-painted figures of insects and the Society's obligation book containing the signatures of such distinguished fellows as Kirby, Darwin, Wallace and Bateson. Numerous charts, photographs, models and drawings gave one a magnificent idea of the different aspects of entomology. Both the academic and economic aspects of the subject were well represented. The exhibition indicated the lines of the rapid advancement of this important branch of science to which the Society that organized it contributed not a little.

* * *

H. E. Sir Fredrick Sykes, the Governor of Bombay, opened on the 7th July, the University Conference at Poona, which was presided over by Dewan Bahadur S. T. Kambli, Minister for Education. In the course of his remarks, His Excellency said that it was time that the Bombay University should be relieved of some of its numbers which were growing almost to unmanageable size and showed no signs of diminishing in the near future. There can be two types for new Universities; one is the regional and the other, residential. The difficulty lay in preventing these Universities from becoming centres of disruptive forces engendering a narrow, commercial outlook full of racial and linguistic prejudices. Whatever be the type of University that may be created the initiative must come from the people. The Government with its difficult financial position, can offer but very little help. Its immediate duty was to restore the grants in full for secondary education.

We believe that there is a great future for Maharashtra University which aims to express Maharashtra Culture. In such a case, Poona would be eminently suited for its centre and the existing Women's University would then be absorbed in the new one. While finance is the greatest obstacle to any immediate realization of this aim, it should, however, be emphasized that if the new University becomes a copy of the existing types turning out innumerable graduates every year whose future is a problem both to them and to the country, it had better

be not even attempted. If it can adjust itself to the new conditions of the country and aim at producing citizens who will be useful to themselves and others, it would be a great step in the educational progress of greater India. We earnestly hope that the founders of any new University in the country will have this ideal as their objective in their labours.

* * *

The inauguration of a Chemical Technology course in the Indian Institute of Science from the July of this year marks a distinct step in the progress of technical education in India. The course which will cover two years, is intended to train a few graduates of different universities to fit themselves for the factory. The need for such trained men in the country is great and no doubt will be greater in the future when the development of Indian industry will become part of the task of national reconstruction. We hope that the results of this experiment will encourage the authorities to widen its scope to accommodate more students and give them a broader training in methods of chemical technology.

* * *

The Andhra University Commission that was constituted with Sir S. Radhakrishnan as Chairman has issued its report. The report contains details of the itenerary in the Andhra districts and the procedure of inspection generally followed by the Commission.

The principles of management of the several colleges, the tone of internal discipline and administration, staff, finances, buildings and hostels of each institution are separately dealt with and a number of useful suggestions are made for their improvement. The Commission is of the opinion that organized steps must be taken to make physical education more widely compulsory and efficient. We note that the libraries of almost all the institutions have come in for a good deal of criticism and library work in general has been ill organized. The Commission makes some very valuable suggestions to remove this defect. The Commission finds that tutorial work is not generally very conscientiously carried out and that there is much spoon-feeding with regard to the teaching of English.

The Commission recommend that the association of practical work in mathematics with theoretical work, which has fallen into disuse or neglect, should be revived and all colleges teaching the subject should be provided with the necessary apparatus which are generally inexpensive. The need for employing people with research qualifications in the teaching of physics and chemistry is strongly emphasized as also the necessity for these teachers to be up-to-date in their knowledge. The Commission recommend the opening of more classes in Biology and also the establishment of a marine biological station at Vizagapatam with a museum and an aquarium attached to it. The importance of magic lanterns in every college and their frequent use are pointed out. The teaching of History seems to be sorely neglected and the reasons are probably overlecturing, failure of the proper use of the library and tutorial work and a lack of genuine interest on the part of teachers. The improvement of the library and the encouragement of reading or publishing original papers are advised. It is also recommended that future teachers of the vernacular languages, Telugu and Sanskrit, must be those who have a good foundation of English. At present it is difficult to get teachers possessing these qualifications and it is hoped that the new courses instituted by the University will supply the need.

A complete survey of the colleges of Andhra area has been undertaken by the Commission and their recommendations, even if a little sketchy, are of great interest as points to be borne in mind when establishing new colleges by any University or Government. It would have been more helpful and illuminating if the report had been written taking into consideration the interests of future universities and colleges so that it could have served as a useful guide to educational authorities.

* * *

In *Current Science* (June 1933) the views of Mr. P. C. Biswas with regard to Mr. Sarkar's article on the 'Mâlers and Malpaharias' (*Current Science*, April 1933) were published. From a letter of Mr. Sarkar to us we learn that his article is a short summary of the result of five years' field work among these tribes. His views are in accordance with those of Dalton, Buchanan, Risley and Roy, and Mr. Biswas has not produced good evidence for the theory of the dual origin of the Mâlers and the Malpaharias.

While Mr. Biswas says that he was not able "to discover a single case of intermarriage" of the Mâlers with the Malpaharias Mr. Sarkar has found more than one such instance and in fact produces a photograph of the Mâler wife of a Malpaharia male.

He adds, "It must be noted that the distinction between the two tribes is not always marked. On the border country, *e.g.*, Bungalows Litipará and Kunjbona in Pakur, there are people who call themselves Malpaharias but speak Malto and *intermarry with Saurias.*"

Before one can accept Mr. Biswas' statement that there are thirteen classes among them instead of eleven as stated by Sarkar, it should be thoroughly ascertained that they are not local variations due to difference in pronunciations, and also genealogies showing these names have to be produced as evidences.

* * *

Ants carrying Aphids during their Nuptial Flight. S. Jones, Esq., Department of Zoology, College of Science, Trivandrum, writes:—

"It is a well-known fact that certain species of ants keep and rear aphids in their nests and live in close association with them.

At about five in the morning on November 2nd, 1932, my lamp was surrounded by a large number of winged male and female ants. The ants were small and honey-coloured, and generally resembled the genus Solenopsis. (The workers belonging to this species have a peculiar habit of erecting their abdomens perpendicularly when irritated.)

Evidently those that came to my table were on their bridal flight, and were attracted by the light. The females were markedly larger and hardier than the males, and they were noticed to carry something white in their mouths which was later found to be a species of Aphids. It was interesting to note, that the females alone carried the creatures and the males did not. They would occasionally deposit their load on the table and pick it up again. The female ants migrating to establish new colonies were evidently carrying

the aphids with them so that they could be reared in their nests.

A few weeks later, I found a nest of the same species of ants with the same species of aphids they were rearing. The aphids were feeding on the small rootlets of a jack tree.

The antennæ of this bizarre-looking aphids were markedly large, and the legs so small in comparison to the size of the body that it could walk but clumsily. No trace of the eyes could be seen, and it appeared to be completely blind. They were wingless and the whole body was covered with hairs, of which those at the posterior end were very long. Each aphid had two or three eggs in its body.

Would any readers of *Current Science* kindly inform me, if during the nuptial flights of these ants, the females alone carry the aphids?

* * *

In the course of a communication on the *Egg-laying Habit of the Marine Bug, Halobates*, Mr. Jones says, "In the *Cambridge Natural History*, Vol. VI, Part II, page 552, Sharp, in his description of Halobates, says, 'The young are frequently met with but there is no doubt that the whole life-cycle may be passed through by the insect far away from land. The Italian ship *Vettor Pisani* met with a bird's feather floating on the Ocean of the Galapagos Island with eggs which proved to be those of Halobates in an advanced state of development.'

Our College Museum possesses a cuttlebone covered with the eggs of Halobates picked up from Kovalam Coast, a few miles away from Trivandrum. During February 1932 I found that many of the cuttlebones washed ashore had the eggs of Halobates laid on them.

The eggs are laid in large numbers and very close together on the convex surface of the shell. The eggs are also laid on the concave surface but never in such large numbers as on the convex side.

The eggs are orange-yellow in colour, long and almost uniformly broad with both ends rounded. The greatest length is 0.90 mm. and the greatest breadth is 0.42 mm.

A piece of cuttlebone with eggs on it was kept in the laboratory for a few days and some of the eggs hatched out as tiny nymphs."

* * *

Stoppage of Research Ruined Chocolate Industry in Ecuador.—A clean cut example of the short-sightedness of "economy" that results in the stopping of scientific research is offered by the South American Republic of Ecuador. The depression hit there earlier than it did in the United States, an economy programme stopped research, and the evil harvest thereof is being reaped.

Fifteen years ago, Ecuador, then one of the principal exporters of cacao, was disturbed by a disease attacking the pods from which the chocolate is manufactured. Although the value of the cacao exceeded that of all the rest of the country's exports combined, there had been no serious attempts to protect it against pests. Studies of this disease were begun, but with the depression of 1921 most of the research work was discontinued; in a few years the uncontrolled spread of the disease forced the abandonment of one of the best of the cacao varieties.

The lapse in the cacao research work proved doubly inopportune. Just at this time a witches-broom disease became conspicuous in one of the important cacao districts. In four years the yield in this district declined to less than one-fortieth of its original volume, and the jungle has taken many of the plantations. The disease spread to other parts of the country and the cacao exports of Ecuador during a period of increasing world consumption dropped by 1930 to less than half their former volume. Resumption of investigative effort has shown that resistant varieties can be produced and the industry may be re-established but too late to save the existing plantations in the regions most affected by the disease.—*Science Service.*

* * *

Mosquito and Charophyta.—Mr. S. C. Dixit, Wilson College, Bombay, writes: "The following list of species of Charophyta having no larvicidal properties and found at Santa Cruz is given at the invitation of Dr. Gosh in his reply (*Cur. Sc.*, April, 1933) to my note on the subject.

1. *Nitella hyalina* Agardh. 2. *Chara succincta*. 3. *C. flaccida* A. Br. 4. *C. zeylanica* Willd.

One is at a loss to find how opinions freely expressed in journals on matters scientific could kill further research on the subject."

* * *

"The Chromosome number of *Crotalaria juncea* Linn."—Mr. R. M. Datta, Department of Botany, Presidency College, Calcutta, writes:—"The plant is a 'rigid shrub cultivated generally and sometimes spontaneous'. (Prain 1903.) The small flower buds were collected from plants on bright sunny days and with a view to counting the chromosome number of this crop plant the anthers were taken out from the small flower buds and teased in a drop of aceto-carmine solution as described by Belling (1926). The metaphase plate in the pollen mother cells showed the haploid number to be 10. Chromosomes are small and rounded but the present writer is not definite about the shape and size of each bivalent."

* * *

In delivering the inaugural address before the Geological Society, Central College, on Thursday, 10th August, Professor L. Rama Rao dealt with the recent advances in our knowledge of the origin of Angiosperms. After giving a critical review of the earlier ideas held regarding this problem, the speaker discussed at some length the hypothesis of the origin of Angiosperms from the Bennettiteans and pointed out how recent studies have shown the impossibility of 'deriving' the Angiosperms from these mesozoic Cycadeoids. He next referred to the interesting group of Jurassic Angiosperms—the Caytoniales—described by Dr. H. H. Thomas in 1925 and showed how this group was definitely more closely related to the forms from which the modern flowering plants sprang. An intensive study of the Caytoniales led Dr. Thomas to put forward the hypothesis of the origin of Angiosperms from several distinct groups of pteridosperms, an idea which derives some further support from the study of some of the recently discovered pteridospermous plants from the Mesozoic rocks of South Africa.

* * *

We acknowledge with thanks the receipt of the following:—

"Nature," Vol. 131, Nos. 3319 to 3323.

"The Chemical Age," Vol. 28, Nos. 728 to 730; Vol. 29, Nos. 731 and 732.

"Berichte Der Deutschen Chemischen Gesellschaft," 66 Jahrg, Nos. 6 and 7.

"Journal of Agricultural Research," Vol. 46, Nos. 8 to 10.

"Memoirs of the Indian Meteorological Department," Vol. 25, Pt. 10.

"Le Cycle Conidien," Vol. 41, No. 4.

"International Geological Congress Pamphlets," 4th Circular and Supplement.

"The Origin of Crochet & Anastomose, Mycological Society of France," Vol. 48.

"Journal of Chemical Physics," Vol. 1, No. 6.

"The Indian Forester," Vol. 59, No. 7.

"Scientific Indian," Vol. 9, No. 54.

"The Mathematics Student," Vol. 1, No. 1.

"Canadian Journal of Research," Vol. 8, No. 5.

"Analytical Methods for the determination of Levulose in Crude Products, U. S. Dept. of Commerce," Research Paper No. 495.

"An Analysis of Lanthanum Spectra (La I, La II, La III) U. S. Dept. of Commerce," Research Paper, No. 497.

"The Review of Scientific Instruments," Vol. 4, No. 6.

"Bulletin of Applied Botany, of Genetics and Plant-Breeding," III Series, No. 2.

"Problem of Alkaloides Lupin."

"University of Cambridge School of Agriculture Memoirs," No. 4.

Boyce Thompson Institute for Plant Research, —*Professional Paper*, Vol. 1, No. 23, "The Injurious Effect of Mercury Vapour from Bichloride of Mercury in Soil of Rose Houses," by P. W. Zimmerman and William Crocker.

Professional Paper, Vol. 1, No. 24. "Properties and Uses of Calcium Cyanamide," by M. M. McCool.

"Contributions from Boyce Thompson Institute," Vol. 5, Nos. 1 and 2.

"American Journal of Botany," Vol. 20, No. 6.

"Journal de Chimie Physique," Tome. 30, No. 5.

"Science Progress," Vol. 28, No. 109.

"Natural History," Vol. 33, No. 4.

"Experiment Station Record," Vol. 68, No. 6.

Reviews.

MODERN THEORIES OF DEVELOPMENT: *An Introduction to Theoretical Biology*. By Ludwig von Bertalanffy, translated and adapted by J. H. Woodger, 1933. (Oxford University Press, London; Humphrey Milford, pp. x+204. Price 8*s*. 6*d*. net.)

This little book is an excellent contribution to the philosophy of Zoology and although named an Introduction, it is fit to be in the hands of advanced students of natural science. The first part of the book is devoted to a critical examination and an evaluation of the leading current theories of the phenomena of life processes. Theoretical biology properly deals with the logic and methodology (including the descriptive and experimental branches) of the vital phenomena of metabolism, development, behaviour, nutrition, reproduction, inheritance and so forth, and the investigations into these topics sometimes touch upon philosophical and cosmological problems also. All these processes are so organized that their main purpose is the maintenance of the wholeness of the organism. The deducing of general rules from the consideration of these vital phenomena is the chief function of general biology.

After analysing the mechanistic conception of the biological events, the author comes to the conclusion that the physico-chemical explanation of the physiological processes does not comprehend the whole problem. Mechanism naturally leaves out of account the fundamental problems such as the specific characteristics of organisms, the organization of vital processes among one another and the historical character of the living organisms and their organic wholeness. The opposite theory of vitalism though it recognizes organic wholeness, refers all the phenomena to a metaphysical or psychical agent and thus precludes the possibility of a scientific explanation. The book sets out to seek a new standpoint which takes account of the organic individuality and wholeness capable of being treated in a manner admitting scientific investigation. This viewpoint is known as *Organismic biology* or the system-theory of the organism. The object of biological investigation is not living substance which has no existence, but living organism. A living organism is conceived as "a system organized in hierarchical order of a great number of different parts in which a great number of processes are so disposed that by means of their mutual relations within wide limits with constant change of the materials and energies constituting the system and also in spite of disturbances conditioned by external influences, the system is generated, or remains in the state characteristic of it or these processes lead to the reproduction of similar systems." It is clear that we can learn nothing of organisms

as such by studying their parts in isolation but in their natural totality they present phenomena which require concepts other than those provided by the mechanistic and vitalistic theories for an adequate scientific explanation.

The second part of the book is devoted to a review of the theories of development advocated by Roux, Weismann, Driesch, Goldschmidt, Köhler and Przibram and Spemann as explanations of vital processes in general. It is concluded that none of these theories,—machine theory, vitalism, mechanism, physiological theory, gestalt theory, crystal theory and organiser theory,—offer a complete and adequate picture of the developmental processes because they attempt to analyse them into particular occurrences proceeding in single parts independently of one another. Therefore none of these views is justified by the facts. The solution is accordingly sought for in the organismic or system-theory of the organisms. It is to be noted that the idea of 'wholeness' forms a factor of most of the theories which are attempted to be replaced. For the explanation of development and life in general, the system-theory comprehends the polyphasic colloidal system of the germ cell, its organization and its faculties collected in geological times, and it is stated that biology must progress in the future towards a complete and satisfactory conception of the biological events of organisms. Two fundamental principles are involved in the system or organismic biology. The first is the law of biological maintenance, which implies that the organic system tends to preserve itself. The second is the principle of hierarchical order which implies that every organism exhibits higher and lower levels of organization both in the static and dynamical sense.

The organismic conception of vital phenomena, no doubt offers new prospects for a more comprehensive view of life and opens out fresh fields in the methods of investigation. The limitation of space imposed by the review forbids a more detailed examination of the theory of entelechy and it seems to us on theoretical grounds that if purposiveness is eliminated from the theory of life, biology reduces itself to a branch of physics and the resources of physical sciences will be found deficient to explain fully the behaviour and evolution of organisms.

In Woodger we have read a remarkable little book which within a short compass offers a brilliant critical analysis of the current biological theories of life processes and after pointing out their inadequacy to give a complete picture, offers a new explanation based on the facts of experimental embryology, which, besides being a satisfactory working hypothesis, possesses a great heuristic value. We have pleasure in offering the book a cordial welcome as an important contribution to scientific literature and in congratulating the author on a clear, precise, and dispassionate presentation of the subject. A full list of literature is provided for the benefit of those who might wish more information than the book offers.

* * *

MODERN BIRTH CONTROL METHODS OR HOW TO AVOID PREGNANCY. By George Ryley Scott with a foreword by Sir W. Arbuthnot Lane. (John Bale & Sons and Danielsson, Ltd., London, 1933. 7/6 net.)

It is doubtful whether the fig leaf or the apple contributed more to human miseries. In fact, neither theologians nor moralists could conclusively establish how the knees sinned more than the face for their shame to be covered. Anything actively and carefully hidden excites unrestrained curiosity and it is true that familiarity breeds indifference. Social progress is measured by the amount of clothing, sophisticated food and sex crimes, besides other standards. Writing in defence of the veil as a biological necessity Sir Mohamed Iqbal points out that woman is a paramount creative element and therefore holy and that in nature the creative forces are hidden. Both these statements are partially true and if nature had really intended that her creative powers should be hidden from gaze, she would have provided her creatures with a natural investment. Among people who wear minimum clothing, the rate of fecundity is very low and the sex attraction is predominant only during the season, while highly seasoned food, heavy clothes and family propinquity favour a high birth rate and medical relief conserves the biologically unfit. According to the doctrines of birth control, the remedy for the rapid multiplication of human population is a widespread practice of contraceptive technique.

It is usually maintained, not by the author of the book under review, that on sociological, economical and eugenical grounds, the knowledge and adoption of

birth control methods are justifiable. We agree that the progress of our civilization should tend towards increasing improvement of the human race, but doubt whether the means suggested will procure the end. If, for instance, the lawyer of Corsica had practised the principles of birth control, the world would not have witnessed the birth and career of Napoleon. This may be said of some of the greatest men and women who have adorned and enriched the age in which they were born. When we talk of the increasing human population we seem to think that the geographical area of the world for colonisation and cultivation is shrinking and that the natural resources to be harnessed for the service of man are nearing exhaustion and that Chemistry has said the last word in regard to the productivity of the land. We have recently been witnessing enormous quantities of coffee burnt, wheat thrown into the sea, and milk poured into the rivers. Assuming that on sociological and eugenical grounds, the government are convinced that birth control methods are to be legally enforced, though none of the writers advocate it yet, we shall have succeeded in producing a society of moralists, saints, wise men and good men. An immaculate and infallible society such as this in which the children lisp the Ten Commandments and men know nothing but holiness and goodness, it is doubtful if some ingenious members will not have the curiosity to experiment on the opposite qualities. This is precisely what happened in that ideal place which we call Heaven and the attempt to establish a night club among the celestials is the subject-matter of the greatest epic in English literature. Has human society any assurance that in preventing the birth of the socially and eugenically unfit, we do not also prevent the birth of saints, geniuses and philanthropists? Are we sure that in abolishing crimes and lunacy we shall succeed in providing the human society with the means of eternal satisfaction, with the purity of morals and a uniform and high rate of standards of efficiency among its members? We shall have a race of population soon not unlike a vast landscape covered with white snow. We attach a value to whiteness because of the presence of the opposite attribute and if everything is white or uniform the whole conception of ethical values and that of the significance of standards will cease to exist. This very weight of monotony is bound to produce an insatiable appetite for variation. Human society derives its picturesqueness from the innumerable gradations of levels just as a landscape owes its beauty to undulations of ground and differences in the size and colour of plants and trees all blended into a vista of magnificent irregularity. Would any advocate of birth control visit twice a zoo where you have a symmetrically arranged series of small marble ponds, filled with distilled water and peopled by white swans with the same colour on the beaks and feet and with nothing else? What would be the condition of man, if we had only oranges constituting the flora of the world? Frankly we do not know how to use the gifts of nature. We have investigated the medicinal, poisonous and life-sustaining properties of plants and our knowledge, though far from complete, enables us to employ the most dreadful poisons for restorative and curative purposes. If the deadly tobacco can be converted into an object of enjoyment, is there any justification for science to despair of finding uses for defective and dangerous human material in the social organism?

We are not convinced that the sociological, economical and eugenical arguments in favour of birth control are sound, but we entirely agree with Mr. Scott when he says that birth control is a private matter for the individuals concerned and that every married couple have the right to decide whether or not they will practise birth control and that the matter concerns none else. Before, however, the individuals decide upon the course of action, we deem it necessary that they should have a complete knowledge of sex anatomy and physiology, the doctors who advise them must have taken a course in the birth control clinics and all should recognize that the technique is fundamentally opposed to the laws of nature and if possible should have the imagination to visualize the consequences of all such practices on the physical and mental well-being of the future generations of mankind.

The book deals with the subject-matter without passion, prejudice or prudery but with absolute candour, the author sets forth the disadvantages and evils attending the use of the different methods. Perhaps the information regarding the contraceptive methods, when given by books such as the one under review, may be imparted to all

and it may be even necessary to do so lest through ignorance and false shame grievous errors are likely to be committed. When sex education is going to form part of the curriculum of studies in the high school stage, we should have no hesitation in placing a copy of this book in the hands of the young people of both sexes in order that they may have a correct and complete knowledge of the birth control technique also. There are a few statements in the book with which one may not agree. Mr. Scott says that "if truth could be got at, I very much question whether women have ever been as keen on child bearing as they have been given out to be" and then he thinks that they dread the repetition of pains, discomforts and dangers connected with child bearing. We think that Lady Chatterley and Mrs. Bolton in the novel are types and their views on these matters are the unexpressed desires of the generality of womankind.

The usefulness of the book is enhanced by the tables giving indications for the different methods, the clinics and their practice, an account of the societies for the propagation of birth control and a selected bibliography and a useful glossary.

It may be necessary for the nation to be warned about the dangers of over-population but it is imperative that it should be warned also about the consequences which the adoption of the proposed remedy is likely to produce in the social organism by its indiscriminate and ignorant application.

* * *

CONTRIBUTIONS TO THE ICHTHYOLOGY OF SIAM. Siam is a more or less mountainous country that lies between Burma on the west and the French Indo-China on the east. The ichthyology of Burma is fairly well known mainly through the researches of Blyth, Day and Vinciguerra, while the fish-fauna of the French Indo-China has been the subject of investigation by several French ichthyologists of great fame. It has also been known for a considerable time that the fresh waters of both of these countries are inhabited by fishes of remarkable interest to systematists and to students of animal adaptations. As the fauna of Siam has received very little attention, the geographical distribution of these remarkable fishes could not be elucidated properly. So far as the study of ichthyology is concerned, Siam could almost be described as a *terra incognita*. The students of Oriental fishes will, therefore, learn with great satisfaction that Dr. Hugh M. Smith has started to publish in a series of articles his notes on the fish-fauna of Siam. These valuable notes are published as "Contributions to the Ichthyology of Siam" in the Natural History Supplement of the *Journal of the Siam Society*. As many as six articles have already appeared in the series (**8**, No. 4, 255, 1932; **9**, No. 1, 53, 1933) dealing with (i) Descriptions of a New Genus and Three New Species of Siamese Gobies, (ii) New Species of Loaches of the Genus Nemacheilus, (iii) A New Goby of the Genus Vaimosa, (iv) A New Genus and New Species of Glyptosternoid Catfishes, and (v) Fishes Not Previously Recorded from Siam. Dr. Smith's researches have not only brought to light several peculiar and highly interesting endemic species, but they have contributed greatly towards the knowledge of distribution of species found in the adjoining regions. The geographical range of several of the Indian species has been extended and the close similarity between the fish-fauna of Burma, Indo-Australian Archipelago and Siam is indicated.

The new species are fully described, their relationships are discussed and they are illustrated with beautiful delineations.

S. L. H.

* * *

THE MODE OF ACTION OF DRUGS ON CELLS. By A. J. Clark, B.A., M.D., F.R.C.P., F.R.S., (Edward Arnold & Co., London. 1933. Pp. 297. Price 18*s*.)

The book under review is entirely novel in its style, inasmuch as it has completely shown the fact, perhaps now-a-days realized by many of the progressive medical men, that without physical chemistry, there can be no further real advances in the knowledge of at least this branch of pharmacology. To probe into the action of drugs on cells, *i.e.*, to place pharmacology on a rational scientific basis in one of its main aspects, by the application of the laws of physical chemistry, is really a task which can only be undertaken by men like Professor Clark. After going through the book, we have no doubt left that he has shown most ably and very beautifully both the usefulness and limitations of these methods in the elucidation of these immensely complicated systems, where the number of variables are many and the precise scientific methods of attack are few. The book will, of course,

be very useful to pharmacologists and physical chemists alike.

R. N. C.

* * *

INFLUENCE OF MANURES ON THE WILT DISEASE OF *Cajanus indicus* Spreng, AND THE ISOLATION OF TYPES RESISTANT TO THE DISEASE. By W. McRae, M.A., D.Sc. (Edin.), F.L.S. and F. J. F. Shaw, D.Sc. (Lond.), A.R.C.S., F.L.S. (69 pp. + 18 illustrations.)

In the series of *Scientific Monograph of the Imperial Council of Agricultural Research*, the above-mentioned publication, which forms No. 7, deserves mention. The research which forms the subject of this Monograph* originated from observations made in the permanent manurial experiments at Pusa in which a differential death rate in *rahar* (*Cajanus indicus*) due to wilt disease was observed in plots which had different manurial treatments.

Part I deals with the influence of superphosphate, cattle manure and green manure on the incidence of wilt and was carried out by the Mycological Section, Pusa. In the Pusa experiments, sulphate of ammonia and of potash showed no effect, whilst cattle manure and superphosphate increased the wilt and green manure definitely tended to decrease it.

The research described in Part II was undertaken with the object of obtaining a type of *rahar* (*Cajanus indicus*) which would be immune, or strongly resistant, to the wilt disease and of elucidating some of those biological factors in the soil which affect the incidence of the disease. The result of the investigation has been the isolation of a type, type 80 (A2) which possesses a considerable degree of resistance to the wilt disease. The quality of resistance has also been found to be present in isolated types 82, 16, 41, 50 and 51. The resistant quality is not correlated with the morphological characters studied. A point of great interest is the loss in the resistance of a resistant type in a field which has been under *rahar* for several years. This loss in resistance, however, is not transmitted to the next generation, the soil conditions which cause the loss in resistance affect the soma of the plants which are exposed to those conditions but not the germ tissue.

The field tests of wilt resistant types were carried out on the Farm and in the Botanical Section by both the Mycological and Botanical Sections.

* * *

AN INTRODUCTION TO TROPICAL SOILS. By Dr. Vegeler, translated by Dr. H. Greene. (Pp. viii+240. London: Macmillan & Co. Price 15*s*. net.)

Since the time Liebig first explained the function of nitrogen, phosphorus and potash in plant nutrition, the study of the soil as the source of these elements commenced. At first, the study was purely from a chemical standpoint, but later on it was extended to physical, physico-chemical and bio-chemical aspects. In recent years, the scope of the enquiry has been extended to the genetical side of the problem from the standpoint of the soil as the medium for crop growth as distinct from the purely geological origin. The result is that the scientific study of the soil has gained in importance to such an extent as to merit the distinctive name *pedology*. It must, however, be stated that the accumulation of data and the advances in soil science were, till a few years ago, based chiefly on the study of the soils of the temperate regions and the information that exists about the soils of the tropics is precious little.

Experience has shown that the knowledge gained from a study of the temperate soils is often inapplicable to soils under tropical conditions. The most important factors concerned in the formation of soils are temperature, rainfall and evaporation. These factors are more intense in the tropics than in temperate regions. It is, therefore, obvious that differences in climatic factors bring about difference in the course and intensity of soil forming processes and in the properties of the resulting soil.

The contribution by Dr. Vegeler on tropical soils and its translation by Dr. Greene is a welcome addition to the meagre literature on the subject. The work deals almost entirely with the soils of Egypt, Sudan, certain American States and Dutch East Indies, and there is practically no information on Indian soils. This circumstance does not, however, detract the value of the publication to workers on soils in India. The book is divided into six chapters of which the fourth and fifth are devoted to a discussion of the views of the different workers on soil formation, of the part played by climate, relief and vegetation

*The Monograph is *in the Press* and will be issued shortly. Copies of the Monograph, as in the case of other Council's publications, can be purchased from the Manager of Publications, Civil Lines, Delhi.

in the formation of tropical soils, of 'Rain factor' and of theories on weathering.

Tabulated statements for the examination and identification of minerals are given at the end. The publication will be of considerable use for all those interested in the study of soils.

B. V. N.

* * *

RECENT ADVANCES IN AGRICULTURAL PLANT BREEDING. By H. Hunter and H. M. Leake. (J. & A. Churchill, London. 1933. Price 15*s*.)

This forms a sister volume to two other books by the same publishers, "Recent Advances in Cytology" by Darlington which is a comprehensive treatise on Karyology, the new science of the nucleus, and "Recent Advances in Plant Genetics" by Sansome and Philip which gives a summary of the most recent developments and views on the phenomena of inheritance in the plant kingdom in general. The three books together meet a great felt need of the present-day geneticist and plant breeder. The present book, according to the authors, has for its object "to present a complete record of all recent investigations with Crop plants". Realizing the magnitude of the task attempted by the authors they have to be warmly congratulated on the very successful way in which they have been able to condense all the salient features of such work in a volume of this size. The introduction for the book written by Biffen, who may be styled the father of breeding work with agricultural crop plants, points out clearly the limitations of this work and how it is inter-related to improvement of cultural and soil conditions. Work done in India has already confirmed the experience of the West that improved strains of crops give a greater response to improved cultural and manurial practices than unselected low-yielding types.

The book reviews practically all the remarkable achievements of breeders of economic crop plants. This is the first useful English publication of the kind after Frwirth's manual in German published years ago and should make an excellent reference book for all crop breeders giving them an idea of the advances that have been made in recent years in crops other than those they are concerned with. The book is divided into two parts, the first one dealing with crops of the temperate regions and the second with crops of the tropical and sub-tropical regions. There is a chapter devoted to each of the crops arranged more or less in the order of their importance and the volume of work done on each of them. For some of the crops where the work has not much advanced, such information as classification, floral morphology, etc., are included in the chapter. Under each crop, the subject is treated from a historical point of view describing the economic conditions which faced the early plant-breeders and giving the origin and pedigree of the most important varieties and strains of crops that have played an important part in the improvement of crops of particular countries. In certain of the chapters are included valuable indications of breeding procedure. The great value of the book can be realized from the fact that it reviews work done in practically every part of the world including Russia which probably stands foremost at present with regard to crop improvement work and which is not sufficiently known outside.

Breeders in the tropics will probably realize the difference in the stage of breeding work that exists between them and those of temperate regions and the headway they have to make to reach up the level of work done in crops like wheat, oats, etc. The book should surely give them valuable guidance for attacking their problems from the solution of similar problems tackled in the temperate regions.

So far as India is concerned we see practically every important work done in recent years in crops (upto 1931) included. There is, however, one significant omission in that there is no reference to Howard's work on wheat in the chapter dealing with this crop.

From the intensive nature of work that is being carried on recently in countries like India, the book, particularly portions of it dealing with the tropical cereals, may require revision at an early date.

K. R.

* * *

LUBRICATING AND ALLIED OILS. By E. A. Evans. (London: Chapman & Hall, Ltd. Pp. 170. Price 9*s*. 6*d*.)

After an interesting but rapid sketch of the history of petroleum and its refining and after reviewing also the sources of occurrence of various fixed or fatty oils, the author enters at length into the discussion of the different modes of physical and chemical tests of the lubricating oils for which a good portion of the book is devoted. The

treatment besides being lucid is intensely practical. In the chapter on the decomposition of petroleum the subject of carbon deposit, on the under side of piston and on the piston head and also in the combustion space, is very ably discussed and the author establishes the fact that the deposit is the result of oxidation. It is not coke or residue left over from the oil.

Without a sufficient working knowledge of the lubricants, it is exceedingly difficult for the chemist to prepare specifications for lubricating oils. The author has placed his special knowledge and experience at the disposal of the chemist and also the engineer and gives very valuable hints to them on the selection of the lubricants, dwelling particularly on specific gravity, viscosity, flash point, loss on evaporation, cold test demulsification value, acidity and liability to carbonise.

The concluding chapter deals with oils suitable for different kinds of machinery and the suggestions given therein appear to be eminently opportune. Most of the types of machinery employed in every day use are dealt with and a suitable lubricant is indicated. We have no hesitation in recommending the book both to the chemist who has to deal with analysis and has to draw up specifications for lubricants but also to the engineer who has to choose and use them. V. G.

* * *

"ERGEBNISSE DER ANGEWANDTEN PHYSIKALISCHEN CHEMIE" Band I, edited by Max Le Blanc, Leipzig, with collaboration from Bergius, Bischof, Heinze, Kroger, Maurer, Valentiner. Pp.xi+417.(Leipzig: Akademische Verlagsgesellschaft m.b.H. Price RM 28·50.)

The book embodies the most recent advances in five distinct subjects without omitting the more important work of fundamental nature of the past upon which such progress has been built. These subjects are: (I) Methods for improving fuel materials, (II) physical chemistry of manganese reaction in the manufacture of steel, (III) manufacture of sugar from wood and similar products, (IV) fundamentals and limits of the elastic properties of caoutchouc and similar substances, (V) modern problems in the preparation of ores and coals, each one of which has been dealt with by competent authorities. The scope of these subjects, without being diffused, has been so judiciously chosen that the reader has a real pleasure in finding all that he seeks to ascertain the general trend of the development in these lines. For the student, specially, this volume is extremely useful, as it gives him a clear notion of the latest improvements, and the deficiencies in processes which he can take upon himself as subjects of research. The printing and the illustrations leave nothing to be desired, and the editor, authors, and the publisher are to be congratulated upon for removing a long-felt want of such a publication in the region of applied physical chemistry.

H. K. S.

* * *

ARMCHAIR SCIENCE: '*The Mechanism of Nature.*' By Prof. E. N. DaCosta Andrade. '*At Home among the Atoms.*' By Prof. James Kendall. (Bell's Popular Science Series, London: George Bell & Sons, 1932. Price, 4*s.* 6*d.* each.)

In 1661, Robert Boyle wrote, "A person anything versed in the writings of chymists cannot but discern by their obscure, ambiguous, and almost ænigmatical way of expressing what they pretend to teach, that they have no mind to be understood at all, but by the *Sons of Art* (as they called them), nor to be understood even by those without difficulty and hazardous trials." This complaint is only too frequently justified. The average book on chemistry, with a few exceptions, is dull and dry, full of experimental details which the lay-reader has no chance of performing or see performed and equations and formulæ that puzzle him sorely. The press is full of popular articles on protons, electrons, photons and now is added to these, the positron. These articles generally leave the reader either muddled or misunderstood. Many of the recent developments in atomic structure are uncertain and even experts differ in their opinion; one needs, therefore, a good background of the previous knowledge of the subject to understand or appreciate the latest addition.

The average man with a good education has little time or patience to get this foundation. But he is eager, especially whetted by the lay-press, to know more about the structure and workings of Nature of which he has but faint perceptions based on elementary lessons of the school-room and probably fainter memories of a few lecture demonstrations in chemistry and physics. And later in life he feels he ought to know more. To such people the two books under review are excellently planned.

Prof. Andrade has attempted to convey to the reader the basic principles of heat, energy, sound and vibrations, light and radiation, electricity and magnetism, the quantum theory and atomic structure including wave mechanics without introducing any technical jargon that confounds with its profundity or mathematics that terrifies with its mystery and in this attempt he has succeeded brilliantly. The present edition of the book is an improvement on the first in that, besides eight plates which add interest to the volume, it includes the latest discoveries in the field of atomic physics, namely, recent work on cosmic rays and the disintegration of elements.

Prof. Kendall has rendered his task equally well. Chemistry has been made a story, almost like Cinderella's adventures (the professor quotes her often). Valency, the Periodic Table, Isotopes, Transmutation of elements, the Bohr atom—have all been presented and explained in a language very reminiscent of the fire-side story and few will deny the need for such a book.

We trust that these two volumes will find a prominent place in every public and college library.

K. S. V.

* * *

ELEMENTS OF CO-ORDINATE GEOMETRY. By J. M. Child, B.A., B.Sc. (Macmillan & Co. Pp. 468. Price 12*s*. 6*d*.)

Broadly speaking, we can distinguish in any living subject of knowledge, three fronts corresponding respectively to the current contributions to the journals, which exhibit knowledge in the making, the standard treatises in the subject, which expose completed and perfected theories, and the text-books for use in colleges which indicate the level of teachers and of general education, and shew in what measure the gains of knowledge have come down from the specialist and the discoverer, into general currency. In a rapidly advancing experimental subject like Physics the distances between the different fronts may be considerable. It is otherwise with a subject like Geometry—meaning the geometry of the linear group and its sub-groups. The general ideas of this subject were more or less completely thrashed out during the last century, and the subject has settled down into coherence of shape and definiteness of scope; it is this logical perfection and roundedness of form which give to Geometry its high educational value, and its cultural and æsthetic supremacy among intellectual disciplines. We accordingly do not find here any very considerable difference between the first two fronts; but the text-books still lag very much behind. They have not yet assimilated the subject, and are not oriented towards its major ideas. To bridge this gap is the problem before the teacher and the text-book writer.

The general defect in all college books on co-ordinate geometry is that they do not pay sufficient attention to the ideas, but present the subject more as a collection of rules; their stress is, in short, on the doing rather than the knowing. In the ideal text-book the conceptual and disciplinary aspects should be found blended together, by the cunning of the teacher's art, into one single process. The conceptual orientation, that is to say, the choice of the ideas to be introduced and stressed upon, should naturally be determined with reference to the major ideas, both general and specific, which have been evolved in the history of Geometry. For example, Klein's great generalization by which any geometry can be regarded as the invariant-theory of a group of transformations would be imaged in an elementary text-book by the attention paid to the formula of transformation of axes, and by stress on the invariance of the metrical relations (distance, angle, etc.) for such transformations. The notion of correspondence, whether between numbers and figures, or between the elements of two figures, is a fundamental and recurring conception in Geometry, and has to be stressed in all its forms and at every stage. Again, while the pole and polar idea is the distinctive feature of the geometry of the conic section, one never finds it treated properly in the text-books, and a similar remark would apply to several other specific ideas of the subject. It is of course inevitable that in course of time, text-books will tend to approach this ideal more and more. In the meanwhile we have to welcome all enterprising attempts of teachers and text-book writers in the reform of Geometry teaching.

The book under review has the excellent get-up which one has learnt to expect, from Messrs. Macmillan & Co. The talented author Mr. Child informs us that the work is the result of an attempt to write a book on Co-ordinate Geometry, which would not be simply a book on Conic Sections. There is no doubt that Mr. Child has succeeded

admirably in his purpose, even though the book is not a very striking achievement from the view-point of the ideal I have explained. Starting with a chapter on Number and Limits, he has explained and exemplified more fully and systematically than any other writer the notions of correspondence which underlie Co-ordinate Geometry. The denial of a separate chapter to the Circle falls into line with this outlook, and is certainly an improvement and a simplification. It is in accordance with the same outlook to treat the normal forms of the parabola, ellipse and hyperbola after the general equation of the 2nd degree. The first half of the book covers the elementary portion; the latter half deals with the advanced portion and includes Harmonic ranges and pencils, poles and polars, points and lines at infinity, Confocal Conics, Systems of Conics, General Homogeneous co-ordinates and miscellaneous methods. The treatment in the later chapters follows Salmon, and has the merit of brevity and clarity.

The author in the introduction claims merit for his novel treatment of the following topics :—

(1) The sign of a line.
(2) The sign of the perpendicular from a point on a line.
(3) The explanation of the line at infinity.

The question of the best way of introducing the line at infinity cannot be discussed in detail here. I shall content myself with remarking, that while everybody will agree that the equation, constant $=0$, for the line at infinity is unintelligible, and that the alternative form, unit of measurement $=0$, may perhaps sound like an improvement, nobody will consider the latter equation to be an 'intelligible' one, as the author appears to do.

As regards the sign of a line and the sign of the perpendicular, let me first remark that they are inter-related concepts. For, by the choice of the positive directions of the x- and y-axes we can fix a positive direction of rotation in the plane. Hence if we require that a line should have a positive moment about the origin, any convention about *either* the sign of the line, *or* about the sign of the perpendicular from a point on it, will determine also the other.

My own opinion is that these two concepts are objectionable ones and should not find a place in a good text-book on Cartesian Geometry. As this is a point on which I seem to differ from all text-book writers, it will be worth while to give my reasons. The angle in Cartesian Geometry always occurs through its tangent, which means that the spirit of Cartesian Geometry does not favour the concept of sign of a line. My criticism against these two concepts is firstly, that they are entirely superfluous (as I demonstrate presently), and secondly, that they are conventional and artificial, and that the precise limits of the convention would not be appreciated by the pupil. If, for example, we agree with the author that the 'positive sign' of a line is that in which the abscissa increases, how are we to convince the pupil that it is natural and proper for the sign to get suddenly reversed, as the line passes the position in which it is parallel to the y-axis? The effect of including such arbitrary hotch-potch conventions in a rational discipline is simply to undermine its efficiency. These two notions are examples of feeble, shadowy imperfect ideas, from which even a rigorous science like mathematics is not entirely free; they should in no case have a place within the well-knit coherence and the clear sunlight of a course in rational Geometry.

The above criticisms derive their strength from the fact that the two notions are entirely unnecessary, that all that matters in elementary Geometry is that the expression $ax+by+c$ takes different signs on different sides of the line $ax+by+c=0$.

To shew this, let me work the following typical problem :—

PROBLEM.—To find whether the origin lies in the acute or obtuse angle between the lines $ax+by+c=0$, $a^1x+b^1y+c^1=0$.

The points in one pair of vertically opposite angles give like signs, and in the other pair, unlike signs to the two expressions. The origin gives them the signs of c, c^1. The line

$$(a+\lambda a^1)x+(b+\lambda b^1)y+c+\lambda c^1=0$$

is perpendicular to $ax+by+c=0$, if $\lambda=\frac{-(a^2+b^2)}{aa^1-bb^1}$

The point $\left\{\frac{-(c+\lambda c^1)}{(a+\lambda a^1)},\ 0\right\}$ on this line gives the two expressions the signs of $\pm\lambda$, ∓ 1. Hence the origin lies in the acute or obtuse angle between the lines, according as aa^1+bb^1 and cc^1 have different signs, or the same sign.

The author has not only obtained a more complicated result (Art. 46, page 95), but has actually gone out of his way to remark (without demonstration), that the condition

that aa^1+bb^1 be of different sign from cc^1 is sufficient but not necessary for the origin to be in the acute angle!

Salmon himself (whom the author has taken as his model) has mentioned the convention for attaching a sign to the perpendicular from a point to a line, but he does not seem to have taken it seriously, or relied on it as a method. It is a pity that the author has not taken the hint from Salmon's discreetness on this question.

R. VAIDYANATHASWAMY.

* * *

THE CONDUCTIVITY OF SOLUTIONS. By C. W. Davies. Second edition, pp. x+281; 32 Figures. Chapman and Hall, 1933. Price 15*s*.)

The numerous additions to our knowledge of solutions which have taken place since 1929, the date of the first edition of this book, have called for a complete revision of the subject-matter and an increase in its volume. The result is admirable. The author breaks the ground with a brief but sufficient account of the older theories of conduction in solution and, without demolishing them entirely, indicates in what respects they require modification. This is followed by the introduction of the concept of "activity" and a very clear account of the modern theory of inter-ionic attraction. This chapter is one of the best in the book and should be read by all students of physical chemistry even those not specially interested in conductivity.

Experimental methods are next dealt with in detail. The author is conservative in this respect, as judging from manner in which he emphasizes the disadvantages of valve oscillators and similar devices, he evidently prefers a simple coil and telephone detector to any other combination of apparatus. It is true that precision measurements with an alternating current bridge require certain precautions which are not evident until considerable experience in work of this nature has been acquired, but it is difficult to understand why it should be possible to neglect these precautions when an induction coil is used as a source of current. A small omission in this section is the failure to mention the very simple and useful tuning fork controlled "microphone hummer" as a source of current.

Following a valuable chapter on solvent correction, experimental results are dealt with in the light of existing theories, the subject-matter being grouped for convenience under two main headings, very dilute, and more concentrated solutions. Use is made of unpublished data in several cases and solvents other than water are fully discussed. A theoretical section follows dealing with the strength of acids, solvolysis, complex ions, amphoteric electrolytes, the mobility of ions and the degree of dissociation. Finally two entirely new chapters have been added describing the methods used in conductivity titrations and some of the technical applications of conductivity measurements.

When so much is excellent it is difficult to single out any portion for special appreciation or criticism. The main character of the work is its lucidity; a careful balance is maintained between theory and practice, and theoretical explanations are sufficient without being tedious. The printing and diagrams are fully in keeping with the subject matter and play no small part in enhancing the value of the book. The paper is perhaps unnecessarily thick and it is questionable whether a slight loss in attractiveness if thinner material were used would not be more than compensated by the resulting reduction in weight. The book can be recommended with confidence to all who are interested in this fascinating subject.

H. E. WATSON.

* * *

PRINCIPLES OF FRUIT PRESERVATION. By T. N. Morris, M.A. (Chapman & Hall, Ltd., London, 1933. Price 15*s*. net.)

The above publication which is the sixth of the series of Monographs on Applied Chemistry is a welcome contribution. It is an admirable short review of the principles of fruit preservation on scientific lines. There are at present a number of books and pamphlets dealing with the subject but very few of them deal with it from the purely scientific point of view. The book under review, therefore, meets a long-felt want of research workers in the line. Divided into three parts, (*a*) canning, (*b*) jam and jelly making, and (*c*) dehydration respectively, the book deals with the processes involved and just touches on the technical aspects of the subject. Special attention is also drawn to the factors of spoilage and the means of controlling them. The effect of temperature and humidity on fruit-preservation is ably treated and well worth the study of those interested in the subject. Methods of sterilization and the use of antiseptics have been discussed and the limits

of their efficiency indicated. The information provided in this section will prove highly useful in the treatment of a large variety of fruits. The vitamin factor in fruits and its preservation by cold storage has also been discussed by the author. The book is well written and will prove to be of value not only to those who are interested in the subject in a general way but also to those actually engaged on the study of the various technical processes relating to fruit preservation.

B. N. B.

* * *

BIBLIOGRAPHY OF TROPICAL AGRICULTURE, 1931. Published by the International Institute of Agriculture, Rome. (Rome · Trevas, Treccani, Tumminelli, 1932.) (English Edition. Price 10 Liras.)

Until the end of 1930 the International Institute of Agriculture, Rome, used to publish in its 'Monthly Bulletin' of Technical information section of the International Review of Agriculture short bibliographical notes on tropical agriculture, but the subsequent publication of these notes became impossible on account of financial reasons. A strong desire for the revival of these bibliographies was expressed at recent meetings of the Bureau of the Commission for Tropical and Sub-tropical Agriculture of the International Council for Scientific Agriculture and a timely donation by the President of the Institute has now rendered possible the issue of a consolidated bibliography for 1931.

The volume has been compiled by Dr. C. J. J. Van Hall, formerly Director of Agriculture, Surinam, and contains about 450 titles dealing in general with technical publications bearing on tropical crops, papers on economics being noticed only when occurring in publications of a wider scope. Each title is followed by a short summary of the article, and the titles are arranged in 12 principal groups: 'Starch and Sugar Plants', 'Oil-yielding Plants', 'Beverage Plants', 'Industrial Crops', 'Vegetables', 'Fruits', 'Forage Crops', 'Green Manure', 'Cover Crops', 'Species', 'Medicinal Plants', and 'Miscellaneous'. The entries under each crop are arranged in alphabetical order by authors, and an alphabetical author index is provided at the end.

In order to avoid waste of effort, time and money it is essential for every scientist to keep in touch with the work being carried on elsewhere in his particular branch of work but this task is becoming increasingly difficult in these days of extreme specialization. The field of tropical agriculture is so extensive and the literature on it so widely scattered in a number of periodicals issued from different countries and in different languages, that research workers in the tropics find it increasingly difficult to keep abreast of recent developments in their subject.

The provision of annual bibliographies like the present one devoted to this special branch of agriculture, should therefore prove exceedingly valuable to those whose time or facilities for consulting current literature are limited, as by this means they can obtain information on any published literature bearing on the particular lines of the investigation in which they are interested. Though the present bibliography is not as complete as one would have desired, it will be specially valuable as a supplement to the existing abstracting journals and deserves to be brought to the notice of all interested in agriculture in the tropics. At 10 liras the book is not expensive.

It is hoped that the Institute's enterprise in restoring the English edition of this useful publication will be supported by Indian scientists. The official language of the Institute being French, it is only possible in these days of financial stringency to issue English editions of those publications which are in real demand.

1405-33. Printed at The Bangalore Press, Bangalore City, by T. Subramania Aiyar, Superintendent, and Published by K. S. Varadachar, M.A., M.Sc., for the "Current Science" Board of Editors, Indian Institute of Science, Hebbal Post, Bangalore.